M1722B CodeMaster XL+ Defibrillator/Monitor User's Guide

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Notice

About This Edition

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As with electronic equipment, **Radio Frequency** (RF) interference between the defibrillator and any existing RF transmitting or receiving equipment at the installation site, including electrosurgical equipment, should evaluated carefully and any limitations noted before the equipment is placed in service

Monitoring during quiescent periods of electrosurgery is possible but electromagnetic interference generated by electrosurgical tools during operation is sufficient to mask cardiac signals. A momentary recovery period is required for the monitor to return to normal operation and will be longer if the diagnostic monitoring mode is used. Pads or electrodes should be placed as far from the surgical area as reasonable while still performing normal function to minimize the possibility of burns. Radio frequency generation from electrosurgical equipment and close proximity transmitters may seriously degrade performance of the CodeMaster XL+ defibrillator/monitor.

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CAUTION

The manufacturer, importer and seller are responsible for the effects on safety, reliability and performance only if: assembly operations, extensions, re-adjustments, modifications or repair are carried out by persons authorized by them, and the electrical installation of the relevant room complies with all local regulations and the equipment is used in accordance with the instructions for use. Use of accessories other than those recommended by Hewlett-Packard may compromise product performance.

THIS PRODUCT IS NOT INTENDED FOR HOME USE.

Responsibility of Manufacturer

Hewlett-Packard only considers itself responsible for any effects on safety, reliability and performance of the CodeMaster XL+ defibrillator/monitor if:

assembly operations, extensions, re-adjustments, modifications or repairs are done by persons authorized by Hewlett-Packard, and

the electrical installation of the relevant room or vehicle complies with the IEC or national requirements, and

the instrument is used according to the instructions for use presented in this manual.

Safety Symbols

Monitor On (Do not confuse with 1 Joule)

Off (Standby)

On/Off

Ground

Shock hazard

Caution - See operating instructions

Meets IEC type BF leakage current requirements and is defibrillator protected.

Meets IEC type CF leakage current requirements and is defibrillator protected.

Equipotential (rear of unit, adjacent to a.c. input)

Protective earth (ground)

Conventions Used in This Manual

WARNING

Warning statements describe conditions or actions that can result in personal injury or loss of life.

CAUTION

Caution statements describe conditions or actions that can result in damage to the equipment or loss of data.

NOTE

Notes contain additional information on usage.

TEXT represents the messages that appear on the display.

key represents keys on the front panel.

LIGHT represents lighted indicators on the key panel.

Preface

This manual provides operational, basic maintenance, and troubleshooting instructions for use and proper care of the Hewlett-Packard M1722B CodeMaster XL+ defibrillator.

This manual is organized as follows:

Chapter 1—Getting Acquainted. Provides basic maintenance instructions for safe use and proper care.

Chapter 2—Defibrillating. Contains information about defibrillating a patient and using different paddle sets for defibrillating.

Chapter 3—Monitoring. Contains information about preparing and monitoring a patient that apply to the synchronized cardioversion and pacing procedures.

Chapter 4—Performing Synchronized Cardioversion. Contains information about performing synchronized cardioversion on a patient.

Chapter 5—Pacing (Optional). Contains information about pacing.

Chapter 6—SpO_2 Monitoring (Optional). Contains information on both cardiac and respiratory systems, and provides details of oxygen transportation in the body.

Chapter 7—Using Advisory Mode (Optional). Contains information on how the CodeMaster XL+ can act as a semi-automatic external defibrillator.

Chapter 8—Troubleshooting. Contains information about troubleshooting and performing diagnostics on the CodeMaster XL+ defibrillator.

Chapter 9—Maintaining the Defibrillator. Contains information about maintaining and cleaning the CodeMaster XL+ defibrillator.

Appendix A—Installation and Setup. Contains information about battery installation and charge, paper installation, and configuration settings.

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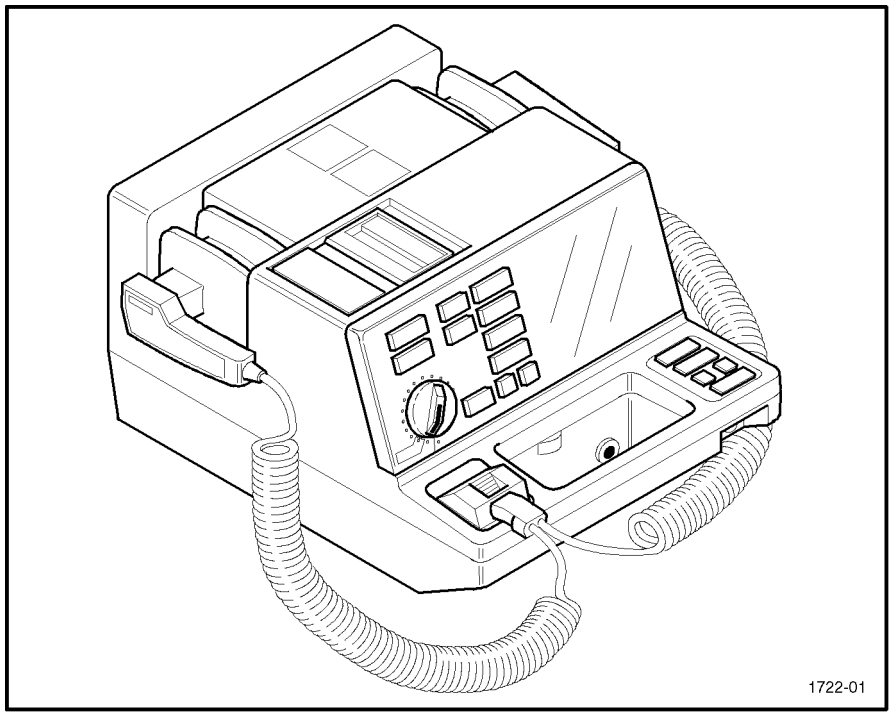
Getting Acquainted

This User's Guide provides operational and basic maintenance instructions for use and proper care of the Hewlett-Packard M1722B CodeMaster XL+ defibrillator/monitor.

Figure 1-1

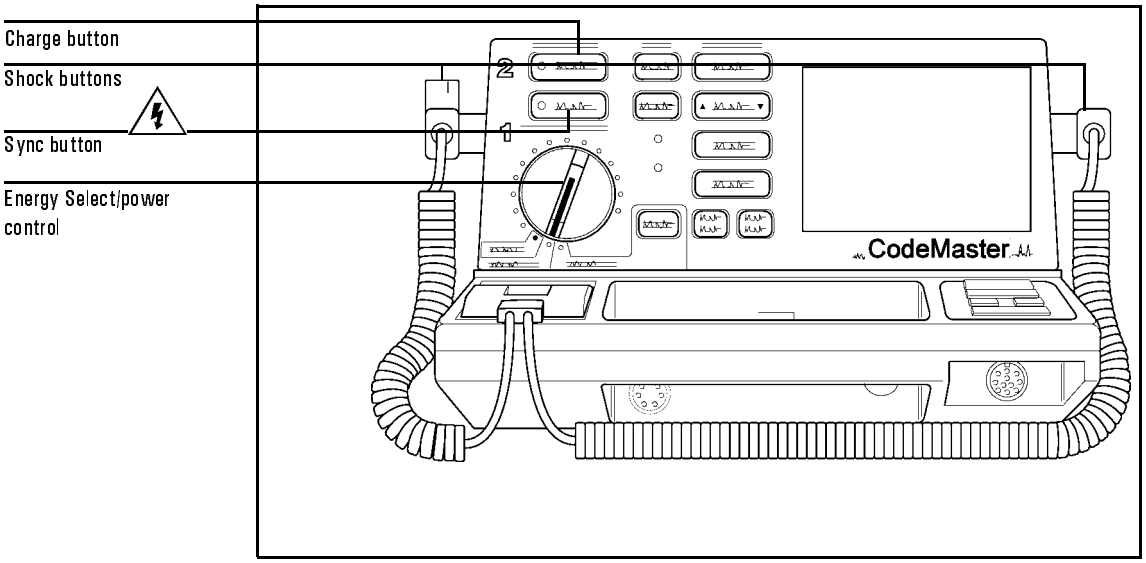


The CodeMaster XL+ Defibrillator/Monitor

Operating Controls and Indications

The following figures and tables detail the controls and indications on the CodeMaster XL+ defibrillator/monitor.

Figure 1-2

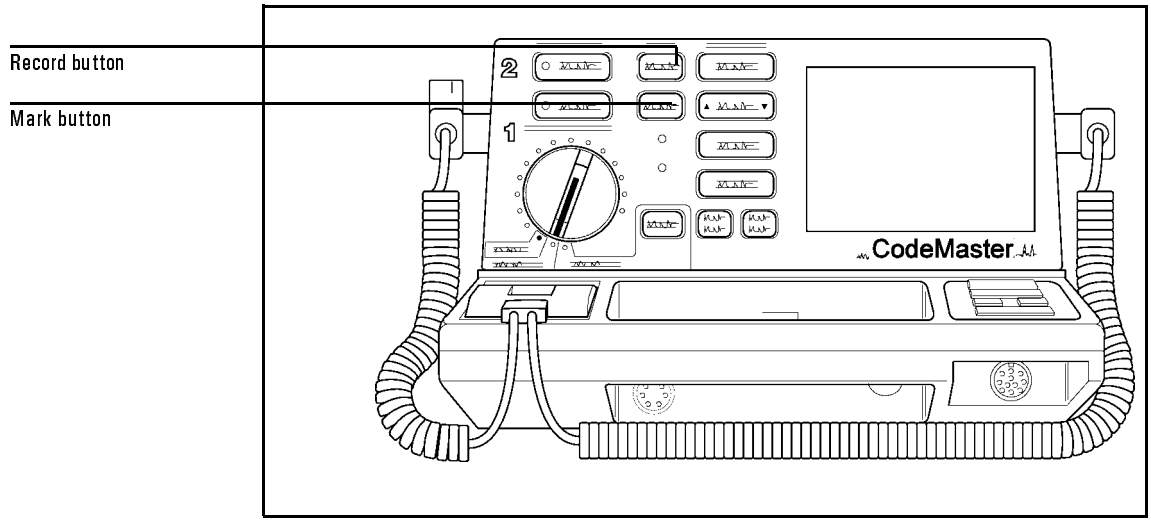


Defibrillator Operating Controls

Table 1-1 Defibrillator Operating Controls

Control	Description
Energy Select/power control	Turns the instrument power on or off and selects energy level.
Charge button	Charges defibrillator to energy level set on Energy Select control.
Shock buttons	Administers shock. Labelled .
Sync button	Changes operating mode between immediate shock (normal) mode and synchronized with next R-wave shock (Sync) mode.

Figure 1-3

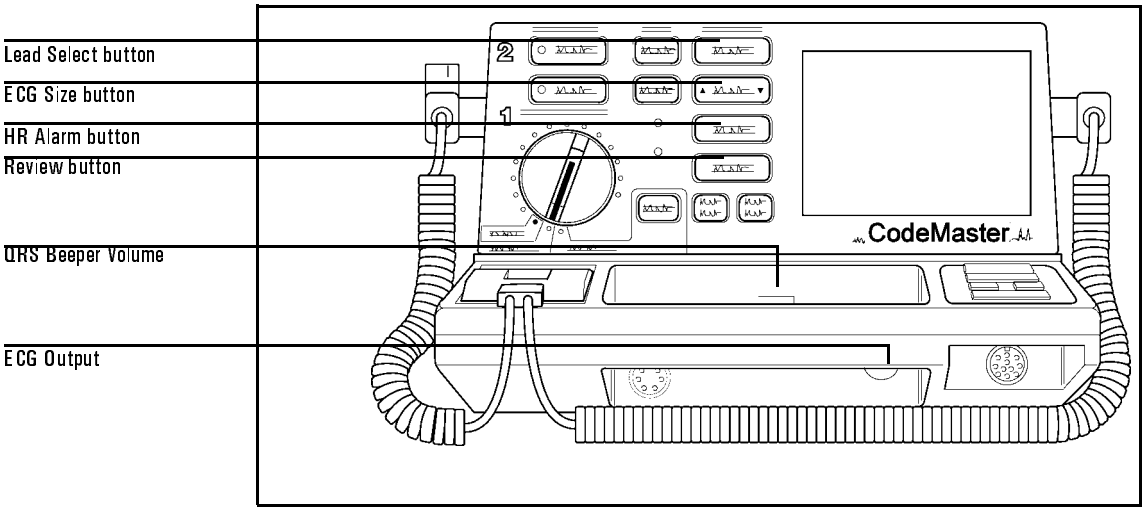


Recorder Operating Controls

Table 1-2 Recorder Operating Controls

Control	Description
Record	Starts and stops the recorder.
Mark	• When the recorder is on, pressing Mark will annotate the ECG at that point. • If the recorder is not on and the unit is set up to do so, pressing Mark will print an ECG strip. • The Mark event is also stored into memory. See Appendix A for information about setting up the Codemaster XL+ for recording when you press Mark (Record on Mark).

Figure 1-4

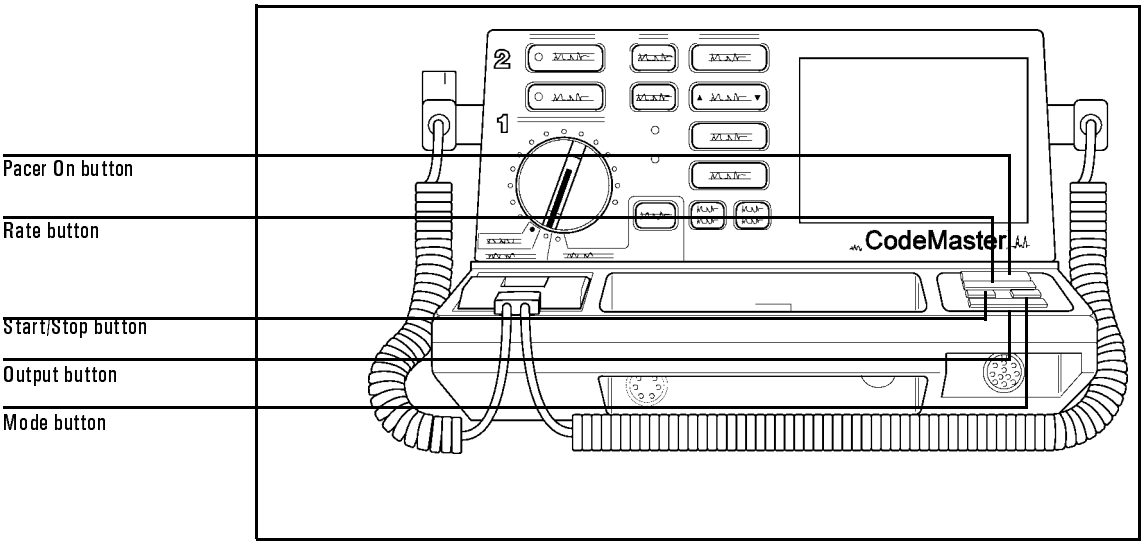


Monitor Operating Controls

Table 1-3 Monitor Operating Controls

Control	Description
Lead Select	Selects an ECG source to monitor.
▼ ECG Size▲	Changes displayed ECG size.
HR Alarm	Controls HR Alarms.
• Review •	Prints an Event Summary record. The message ES is printed at the top of the ECG strip when you print the Event Summary record. The recorder must be off to print an Event Summary with this key.
QRS Beeper Volume	Controls volume of QRS beeper.
ECG Output	Provides analog 1V/mV output for external monitoring.

Figure 1-5



Pacer Operating Controls

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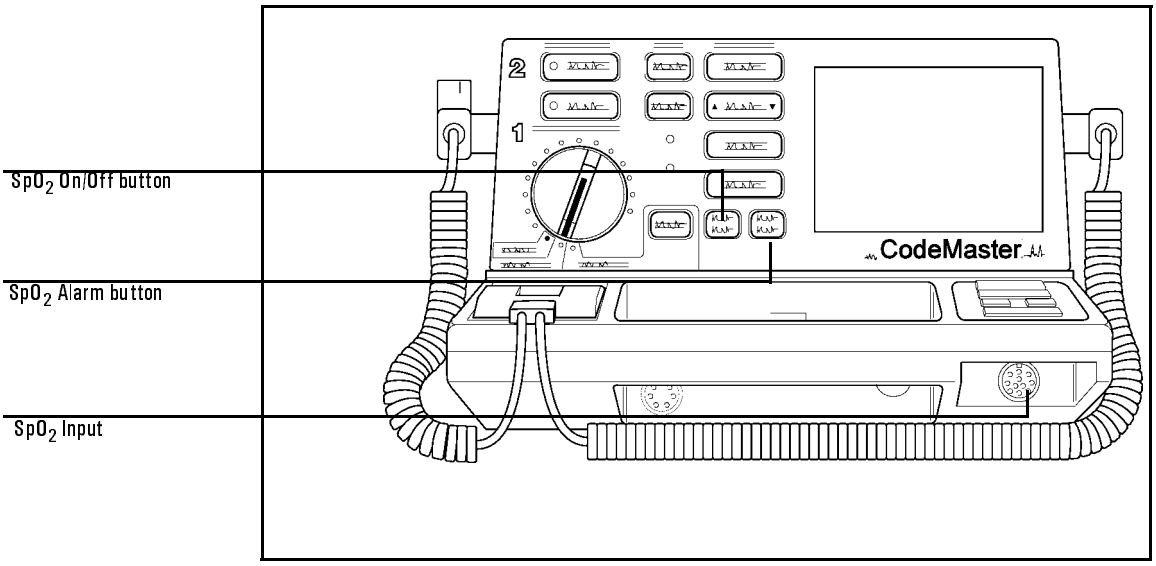
Table 1-4 **Pacer Operating Controls**

Control	Description
Pacer On	Turns pacer on or off.
▼ Rate ▲	Adjusts pacer rate (ppm) up or down.
Start/Stop	Starts or stops pacing.
▼ Output ▲	Adjusts pacer output current (mA) up or down.
Mode	Changes between fixed or demand pacing modes.

Figure 1-6

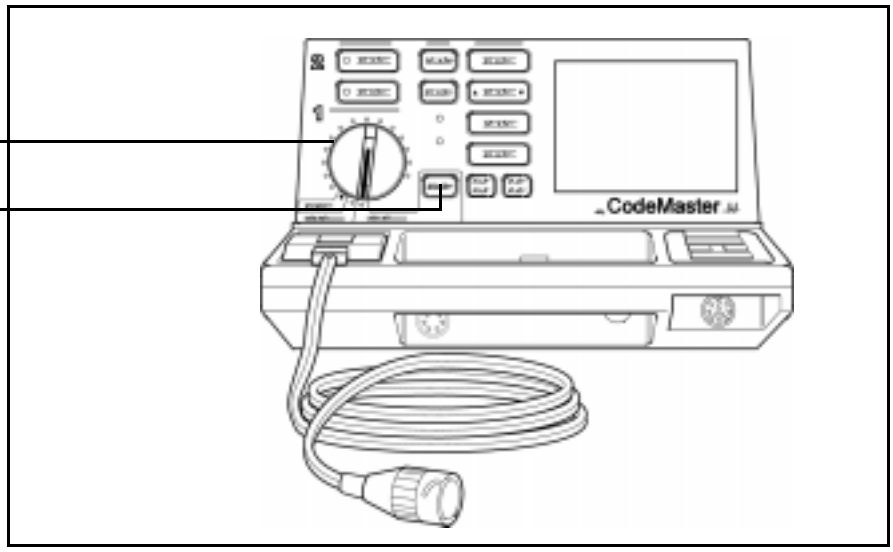


SpO_2 Operating Controls

Table 1-5 **SpO_2 Operating Controls**

Control	Description
SpO_2 On/Off	Turns pulse oximeter on or off.
SpO_2 Alarm	Activates, selects and deactivates SpO_2 alarms.
SpO_2 input	Connector for SpO_2 sensor or sensor adaptor cable.

Figure 1-7

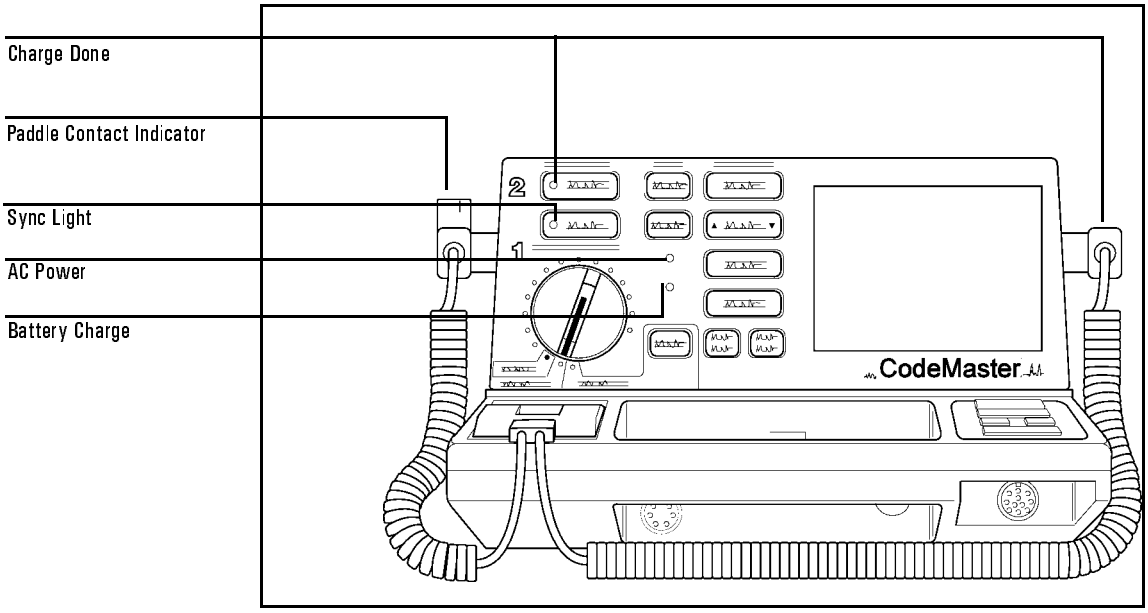


Advisory Mode Operating Controls

Table 1-6 Advisory Mode Operating Controls

Control	Description
Energy Select/power control	The Advisory On position places the CodeMaster XL+ into Advisory mode.
Analyze	Turns on automatic analysis of ECG waveforms.

Figure 1-8



Indicator Lights

Table 1-7 Indicator Lights

Indicator	Description
Charge Done	Indicates that unit is charged and ready to deliver a shock. CHARGE DONE lights on key panel and on Apex paddle.
Paddle Contact Indicator (PCI) on Sternum paddle	Indicates when adequate pressure is applied.
SYNC Light	Indicates that unit is in synchronized shock mode as opposed to defibrillator mode. Flashes off each time an R-wave is detected.
AC Power	Indicates that unit is plugged in to AC power.
Battery Charge	Indicates that the unit is plugged into AC power and that the battery is being charged.

Table 1-8 **Audible Indicators**

Indicator	Description
Charge Done tone	Sounds when instrument is charged and ready to deliver a shock. *Can be disabled in setup*.
Auto disarm tone	Sounds during the last ten seconds of the Charge Done tone. Beeps intermittently until disarmed.
QRS beeper	Sounds whenever an R-wave is detected. Volume controlled by front panel adjustment.
CRT alerts	Three beeps each time a message appears on the screen. Can be disabled in setup.
HR alarms	Sounds if the heart rate is above the higher alarm limit or below the lower alarm limit.
SpO_2 alarm	Sounds if the SpO_2 level is above the high SpO_2 alarm limit or below the low SpO_2 alarm limit.
Shutdown alarm	Alternating pitch sounds for 60 seconds when the system is about to turn off. *An alert to plug the unit into AC power*.

Safety Considerations

The CodeMaster XL+ stores high voltage energy and is capable of delivering up to 360 joules of DC energy to a 50 ohm impedance.

- To remove power from the instrument, you must turn the Energy Select control to Off (Standby). Disconnecting the CodeMaster XL+ from an AC outlet will not remove power because the instrument is battery powered.

- To disarm a charged instrument, use one of three methods:
  - Turn the Energy Select control from an energy level setting to the Monitor On or Off (Standby) position.

    or

  - Place the paddles in their holders and depress both Shock buttons.

    or

  - Leave the unit charged for 60 seconds and it will automatically disarm.

CAUTION

- Do not leave the instrument turned on when it is not in use and it is not plugged into AC power.

- Do not discharge the defibrillator with the paddles shorted together. To do so can cause burning and pitting of the metal paddle contacts.

- Disconnect any other medical electronic equipment from the patient during defibrillation discharge unless labelled as defibrillator protected. (and)

WARNING

- **Avoid open paddle discharges. Dangerous high voltage exists on the paddles when the defibrillator is discharged. Contact with this high voltage could cause death or serious injury.**
- **Avoid touching any metal surfaces on the instrument during shock.**
- **Avoid connecting the patient to several devices at once, because leakage current limits can be exceeded.**
- **Never touch the bed, the patient, or any equipment connected to the patient during defibrillation.**
- **Keep the CodeMaster XL+ and the immediate area clean and dry at all times to avoid creating potentially dangerous electrical paths.**
- **Never open the instrument case. Dangerous high voltages can be exposed. Only qualified service personnel can service the instrument.**
- **Do not use the defibrillator in a flammable or oxygen-rich atmosphere. This will cause an explosion hazard.**
- **Do not rely entirely upon heart rate alarms. Rate meters on patients can continue to count the pacemaker rates during cardiac arrest or some arrhythmias. Keep pacemaker patients under close observation.**
- **Avoid moving a charged defibrillator. If the unit is dropped, it may discharge.**

AC / Battery Operation

The CodeMaster XL+ defibrillator can be operated on AC line power. The following is a list of AC and battery operating instructions.

- The battery will charge when the instrument is connected to AC power even if the Energy Select switch is in the Off (Standby) position.
- Battery charging is indicated by the BATT CHRG light being on.
- A fully depleted battery will recharge to 90% of full capacity in two hours and 100% capacity in 18 hours. To preserve battery integrity, the battery must be fully recharged each time the battery is depleted.
- A new battery or one that has been stored for an extended period requires 24 hours of charging before use.
- When the unit is not in use, connect it to AC power with the Energy Select switch position off. This is to maintain a full battery charge and to prolong battery life.
- To operate on internal battery power only, disconnect the power cord from the AC outlet.
- A fully charged battery will nominally provide fifty 360 joule charge-shock cycles or 2.5 hours of continuous monitoring (15° C-40° C).

NOTE

Continuous recording will reduce monitoring time available when you are using the unit on battery power.

CAUTION

When the LOW BATTERY message is displayed on the monitor, plug the unit into AC power.

From the time the LOW BATTERY message is first displayed to when the battery capacity is fully depleted (instrument shutdown), there is typically enough reserve battery capacity to provide either 30 minutes of monitoring, or five 360 joule charge-shock cycles.

If a battery is defective, there is significantly less monitoring or charge capacity available after the LOW BATTERY message appears than if the battery is merely depleted.

A unique audible alarm will sound continuously when there are 60 seconds of battery capacity remaining. The instrument will automatically shut off after 60 seconds.

If the battery has been fully depleted, plugging the instrument into AC will immediately restore full operation.

Frequent battery discharges to the low battery level will degrade battery life.

Battery Life

The sealed lead-acid battery used in the CodeMaster XL+ will provide optimum life when the unit is continually connected to AC power when not in use. The battery operates best when it is fully charged after each use. To fully charge a depleted battery requires 18 hours of continuous charge time. Because it is not always practical to allow a full charge cycle between uses, the CodeMaster XL+ can charge a depleted battery to 90% of its capacity in approximately two hours. However, battery capacity and battery life will be reduced if the battery is not allowed to fully charge after each use. For improved battery life, consider ways to reduce the number of instrument uses between full charge cycles.

When the instrument is not plugged into AC power, some current is drawn from the battery to maintain memory and startup logic. Remove the battery if the instrument is to be stored for extended periods (more than one month) without AC power. Note on the instrument that the battery has been removed. After an extended storage period, test the battery according to the battery capacity check as described in “Maintaining the Battery” on page 9-3.

This battery was selected because it provides optimum performance and battery life over a wide range of operating conditions. The life expectancy of this battery is dependent on many variables, including temperature and usage. Periodically check the battery capacity to determine whether to replace it. The battery capacity check is described in “Maintaining the Battery” on page 9-3.

NOTE

When plugged into AC power, the CodeMaster XL+ will function normally with no battery installed, however the time required to charge the defibrillator will increase.

WARNING

If the CodeMaster XL+ is operated without a battery installed, clearly mark the instrument that it does not have a battery and requires AC power to operate. When a CodeMaster XL+ has no battery installed and is plugged into AC power, the front panel AC POWER light will be on and the BATT CHRG light will be off.

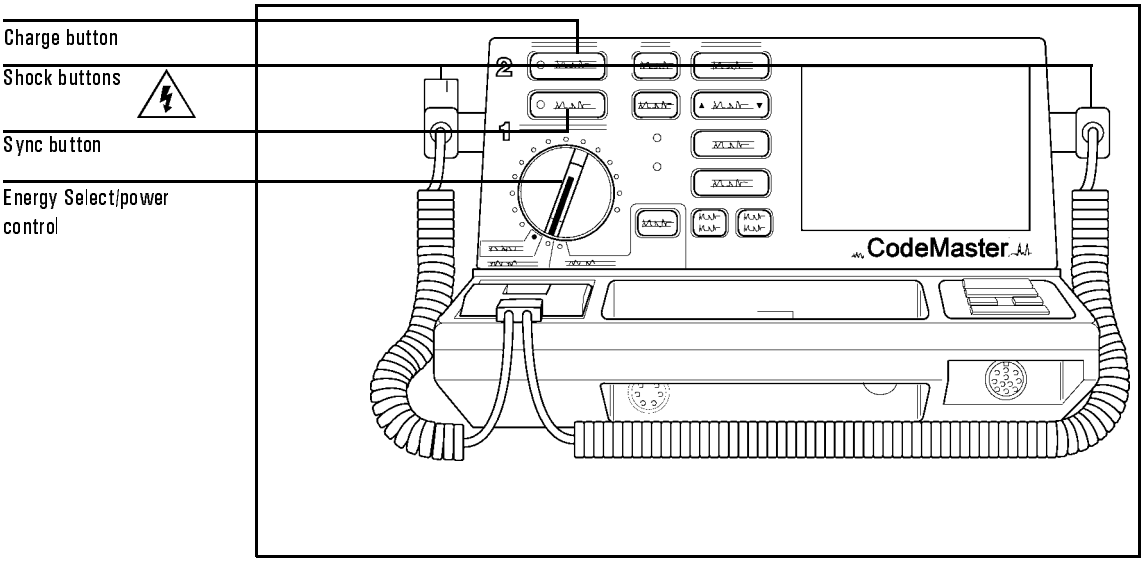
WARNING

Properly dispose of or recycle depleted batteries according to local regulations. Do not disassemble, puncture, or incinerate the disposed batteries.

Defibrillating

This chapter contains information about defibrillating a patient and using different paddle sets for defibrillating.

Figure 2-1



Defibrillator Control Panel

Defibrillating a Patient

The following section describes the three steps to defibrillating a patient:

1 Select Energy

2 Charge

3 Shock

1. Select Energy

1 Turn the Energy Select control to the desired energy level. The defibrillator is now on.

2 Prepare the paddles by following these steps.

a. Remove the paddles from their holders by grasping the handles and lifting them straight up.

b. Holding both paddles in one hand, apply electrolyte paste to the electrode surface of each paddle.

WARNING

Do not allow paste to accumulate on your hands or on the paddle handles to avoid risk of electrical shock.

CAUTION

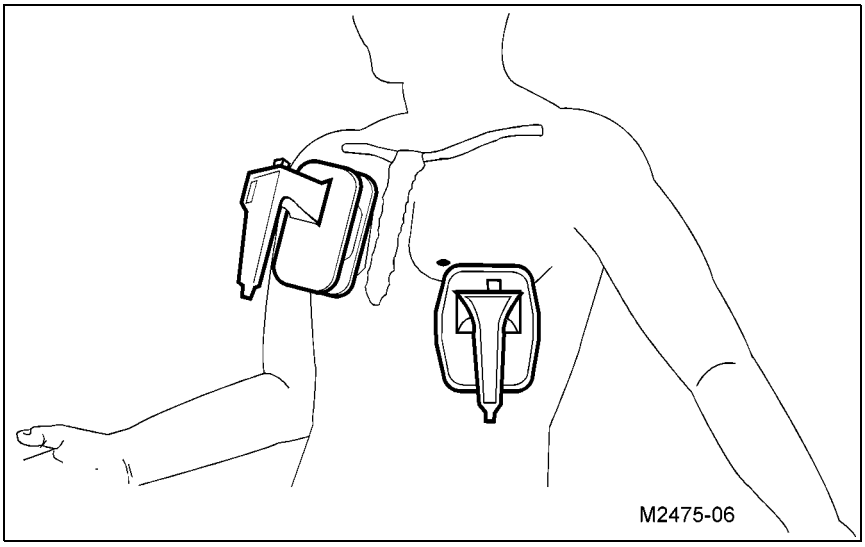
Do not rub the electrode surfaces together to distribute the applied paste. Placing the electrode surfaces together increases the risk of an accidental paddle-to-paddle discharge.

3 Apply the paddles as described in Figure 2-2.

a. Place the Sternum paddle near the upper sternum in the patient’s right mid-clavicular line, just below the clavicle.

b. Place the Apex paddle on the chest just below and to the left of the patient's left nipple, in the anterior-axillary line.

Figure 2-2



Paddles placement for defibrillation

4 Rub the paddles lightly against the skin to distribute the electrolyte paste and increase contact between the patient skin and the paddles. Then keep the paddles still to reduce motion artifact on the monitor.

WARNING

Do not spread paste between the paddle electrodes on the chest. The patient can be burned if the paste forms a path between the electrodes.

5 Apply 10 to 12 kg (22-25 lbs) of pressure to the paddles.

2. Charge

1 Press Charge on either the Apex paddle or on the instrument front panel.

2 Call out "Clear!" to alert personnel to stand away from the patient.

3 Wait for the charge done indicators: CHARGE DONE light and Charge Done tone. When the unit is armed, the monitor Delivered Energy display shows the available energy in joules.

If the defibrillator does not charge, refer to Chapter 8, ”Troubleshooting”.

Resetting the Selected Energy Level

To increase or decrease the selected energy level after pressing the Charge button, perform the following steps.

1 Move the Energy Select control to the new energy level.

2 Wait for the Charge Done indicators.

3. Shock

To shock the patient, perform the following steps.

1 Briefly adjust paddle pressure and placement to optimize patient contact, as registered on the paddle contact indicator (if supplied).

2 Verify that no one is in contact with the patient, the monitoring cable or leads, the bed rails, or another potential current pathway.

3 Call out "Clear!" to alert personnel to stand away from the patient.

WARNING

Keep hands clear of the paddle electrode edges. Use your thumbs to depress the Shock buttons on the paddle handles.

4 Press and briefly hold both Shock buttons (one on each paddle) simultaneously, to deliver energy to the patient.

If the defibrillator does not shock, refer to Chapter 8, ”Troubleshooting”.

NOTE

If you must disarm the charged defibrillator (if countershock is not needed), turn the Energy Select control to Monitor On. Any stored energy will be discharged internally and the available energy on the display will return to 0.

After Using the Defibrillator

If installed, if you want to print an Event Summary now, press [• Review •]. See "Printing the Event Summary Record (Optional)" on page 3-8. After you use the defibrillator, perform the following steps to prepare the defibrillator for its next use.

1 Turn the Energy Select control to Off (Standby).

2 Return the instrument to its storage location, and plug the power cord into an AC power outlet. Verify that the BATT CHRG and AC POWER lights are on.

3 Clean all paddles, controls, and cables. Refer to Chapter 9, "Maintaining the Defibrillator" for cleaning instructions.

4 Check that sufficient recorder paper and electrolyte paste or defibrillator electrodes are available for the next use of the defibrillator.

Defibrillating with Alternate Paddle Sets

The CodeMaster XL+ will defibrillate with several different electrodes/paddles sets.

• Adult/Pediatric Anterior/Anterior External Paddles

• Anterior/Posterior Paddles

• External Multi-Function Defib Electrodes

• Internal Paddles

WARNING

Do not switch paddle sets in an environment where water may get in the electrodes/paddles connector receptacle.

Performing Pediatric Defibrillation

The CodeMaster XL+ paddle set comes with pediatric paddles. To use the pediatric paddle set, depress the release latch at the front of the standard external paddle set while pulling forward on the adult paddle surface. This action will remove the adult paddle contact surface and expose the smaller pediatric contact surface. When

pediatric paddles are in use, the adult electrode plates may be conveniently stored in the paddle pockets of the defibrillator.

Refer to “Defibrillating a Patient” on page 2-1 for defibrillation procedures.

WARNING

The clinician must select an appropriate energy level for the pediatric patient. There is no energy limit lockout for the pediatric paddle set.

Defibrillating through External Multi-Function Defib Electrodes

The CodeMaster XL+ has an external electrodes adaptor that is optional. This adaptor allows defibrillation through external adhesive electrodes.

External Electrodes have the following advantages.

- They allow "hands off" defibrillation.
- They provide good quality monitoring.
- You can perform synchronized cardioversion without using an ECG lead set, while monitoring through the electrodes.
- If the optional pacer is installed, you can switch between the pacing and defibrillation modes of operation quickly.

WARNING

The defibrillator will deliver energy to an open electrodes set. The message PADS OFF appears when there is a poor electrodes-to-patient contact. Check all patient connections if this message appears. If possible, dry off the patient's chest prior to applying the electrodes.

1. Attach the electrodes adaptor cable (M1750A/B) to the paddle connector on the front of the defibrillator.
2. Slide the paddle connector lock towards the front of the defibrillator to secure the cable.

3 Attach the electrodes to the patient as instructed on the package.

4 Connect the electrodes to the electrodes adaptor cable. The electrodes are correctly connected when the locking ring is twisted, locking the ears of the connector to the adaptor cable.

WARNING

Failure to correctly connect the electrodes to the adaptor cable can result in a failure to deliver energy to the patient.

If the PADS OFF monitor message is displayed, check all patient connections.

5 Select electrodes as the ECG source by pressing [Lead Select] until PADS appears on the display under the heart rate.

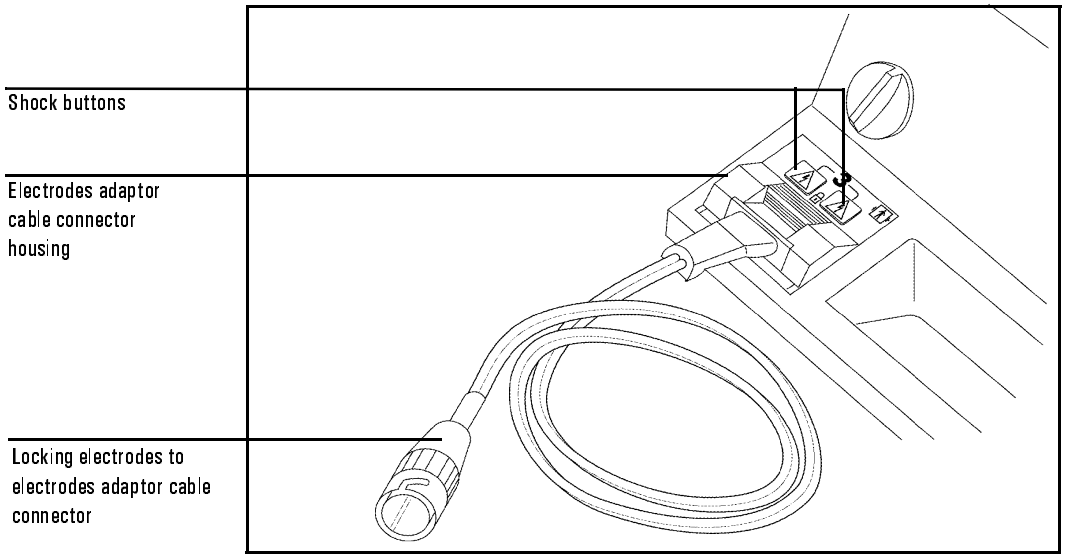
6 Set Energy Select control to desired energy.

7 Press [Charge] .

8 Wait for the Charge Done indicators.

9 Press both Shock buttons at once to defibrillate. The Shock buttons for external electrodes are on the cable connector housing.

Figure 2-3



Electrodes Adaptor Cable

Performing Internal Defibrillation

You can perform internal defibrillation using one of the optional internal defibrillation paddle sets.

The Switchless paddle sets attach to the internal paddles adaptor cable (M1740A/B). The Shock buttons are on the connector housing of the internal paddle adaptor cable.

The Switched paddle set does not require the internal paddles adaptor cable. This paddle set has a single Shock button on the right-hand paddle handle.

Switchless Paddles To defibrillate a patient internally, using the switchless paddles, perform the following steps.

1 Attach the internal paddles adaptor cable (M1740A/B) to the paddle connector on the front of the defibrillator.

2 Slide the paddle connector lock towards the front of the defibrillator to secure the cable.

3 Select correct paddle set size from Table 2-1, “Switchless Internal Paddles Selection,” on page 2-10.

4 Attach the internal paddles set to the internal paddles adaptor cable. The electrodes are correctly connected when the locking ring is twisted, locking the ears of the connector to the adaptor cable.

WARNING

Failure to correctly connect the internal paddles to the adaptor cable can result in a failure to deliver energy to the patient.

5 Set the Energy Select control to the desired energy.

NOTE

If the energy switch is set to a level greater than 50 joules, `50J MAXIMUM` will be displayed. If Charge is pressed, the unit will only charge to 50 joules.

WARNING

For safety and sterility when using the paddles, do not touch the paddle beyond the fingerguard on the handle.

6 Apply the internal paddles.

7 Press Charge .

8 Wait for the Charge Done indicators.

9 Press both Shock buttons at once to defibrillate. The Shock buttons are on the cable connector housing.

Table 2-1 **Switchless Internal Paddles Selection**

Part Number	Description
M1740A/B	Internal paddles adaptor
M1741A	Internal paddle set, 7.5 cm diameter
M1742A	Internal paddle set, 6.0 cm diameter
M1743A	Internal paddle set, 4.5 cm diameter
M1744A	Internal paddle set, 2.8 cm diameter

Switched Paddles To defibrillate a patient internally, using the switched paddles, perform the following steps.

1. Select correct paddle set size from Table 2-2, “Switched Internal Paddles Selection,” on page 2-11.
2. Attach the switched internal paddles cable to the paddle connector on the front of the defibrillator.
3. Slide the paddle connector lock towards the front of the defibrillator to secure the cable.
4. Set the Energy Select control to the desired energy.

NOTE

If the energy switch is set to a level greater than 50 joules, `50J MAXIMUM` will be displayed. If [Charge] is pressed, the unit will only charge to 50 joules.

WARNING

For safety and sterility when using the paddles, do not touch the paddle beyond the fingerguard on the handle.

5. Apply the internal paddles.
6. Press [Charge] .

7 Wait for the Charge Done indicators.

8 Press the Shock button on the right-hand internal paddle handle.

Table 2-2 Switched Internal Paddles Selection

Part Number	Description
M1784A	Internal paddle set, 7.5 cm diameter
M1785A	Internal paddle set, 6.0 cm diameter
M1786A	Internal paddle set, 4.5 cm diameter
M1787A	Internal paddle set, 2.8 cm diameter

Defibrillating with Anterior/Posterior Paddles

The M2495A Anterior/Posterior Paddles are similar to the anterior/anterior paddles, but provide a posterior electrode placed on the patient's back. Refer to the packaging provided with the paddles for placement and usage guidelines.

Monitoring

This chapter contains information about monitoring a patient with the CodeMaster XL+ defibrillator/monitor. This chapter also contains details of patient preparation that apply to the synchronized cardioversion and pacing procedures described later in this manual.

The CodeMaster XL+ can be used for either short term or long-term cardiac monitoring. A fully charged battery pack provides a minimum of two and a half hours of continuous monitoring. The power cord can be connected to AC power for unlimited monitoring periods.

Using Leads to Monitor

The CodeMaster XL+'s monitoring functions can be used for cardiac monitoring, elective cardioversion, and pacing (optional). Table 3-1, "Cardiac Monitoring Configurations" details the different ECG sources that can be used for cardiac monitoring and monitoring applications for which each is suited.

Table 3-1 **Cardiac Monitoring Configurations**

For this ECG source...	Use this cable type...	In this monitoring application...
LEADS, LEAD I,II,III	**3-Wire:** • 6 Pin - M1731A • 8 Pin - M1733A • 8 Pin - M1735A (IEC) • 12 Pin - M1605A/M1500A • 12 Pin - M1615A/M1510A (IEC)	• ECG Monitoring. • Synchronized Cardioversion. • Pacing.
LEADS, LEAD I,II,III,aVR,aVL, aVF, and V	**5-Wire: (optional)** • 6 Pin - M1732A • 8 Pin - M1734A • 8 Pin - M1736A (IEC) • 12 Pin - M1625A/M1520A • 12 Pin - M1635A/M1530A (IEC)	• ECG Monitoring. • Synchronized Cardioversion. • Pacing.

Table 3-1 **Cardiac Monitoring Configurations**

For this ECG source...	Use this cable type...	In this monitoring application...
Electrodes	• Electrodes adaptor cable: M1750A/B • Multifunction Defib Electrodes	• ECG Monitoring. • Synchronized Cardioversion. You can use these electrodes for pacing, however you must select LEADS as the monitor source during pacing.
PADDLES	Standard with instrument M1747A/B	Emergency ECG Monitoring.
MONITOR	Monitor adaptor cable: 14482A 14482B	Synchronized • 8' (2.5m) • 25' (7.8m)

Preparing the Leads for Monitoring

The optional 5-wire functionality allows CodeMaster XL+ to be configured to use either a 3-wire or a 5-wire patient cable. Use setup menu 2 as described in Appendix A to select the patient cable type (3-wire, 5-wire).

3-Wire Patient Cable

Table 3-2, "3-Wire Electrode Placement", describes typical lead-wire placement using the 3-wire patient cable. Table 3-3, "Lead Formation", shows how the individual leads are formed using the individual leadwires.

Table 3-2 **3-Wire Electrode Placement**

Electrode AHA (IEC)	Placement
RA/White (R/Red)	Near right midclavicular line, directly below the clavicle.
LA/Black (L/Yellow)	Near the left midclavicular line, directly below the clavicle.
LL/Red (F/Green)	Below the left pectoral muscle on the left midclavicular line.

Table 3-3 **Lead Formation**

Lead	+	–	ref
I	LA	RA	LL
II	LL	RA	LA
III	LL	LA	RA

5-Wire Patient Cable

Table 3-4, “5-Wire Electrode Placement”, describes a typical lead-wire placement using the 5-wire patient cable. Table 3-5, “Lead Configurations”, shows how the individual leads are formed using the individual leadwires.

Table 3-4 **5-Wire Electrode Placement**

Electrode AHA (IEC)	Placement
RA/White (R/Red)	Near right midclavicular line, directly below clavicle.
LA/Black (L/Yellow)	Near left midclavicular line, directly below clavicle.
LL/Red (F/Green)	Below the left pectoral muscle on the left midclavicular line.
RL/Green (N/Black)	Below the right pectoral muscle on the right midclavicular line.
V/Brown (C/White)	As appropriate for the V lead to be monitored (V1 - V6).

Table 3-5 **Lead Configurations**

Lead	Leadwire Combinations
I	LA - RA
II	LL - RA
III	LL - LA
aVR	$RA - \frac{LA + LL}{2}$
aVF	$LL - \frac{RA + LA}{2}$

Table 3-5 **Lead Configurations**

Lead	Leadwire Combinations
aVL	$LA - \frac{RA + LL}{2}$
V	$V - \frac{RA + LA + LL}{3}$

Preparing the Patient

Proper application and placement of electrodes is essential for quality ECG monitoring. Good contact between the electrode and the skin reduces the effects of motion artifact and signal interference.

1 If necessary, shave hair from the site to ensure good electrode to skin contact.

2 Clean the skin with soap and water or with alcohol, then wipe it dry.

NOTE

You can safely monitor a patient during defibrillation. However, monitoring electrodes can become polarized during defibrillation shock, causing the ECG waveform to briefly disappear from the display. You can reduce this effect by using silver- silver chloride electrodes.

3 Attach disposable electrodes, perform the following steps.

a. Peel the protective backing from the electrode. Be careful to keep adhesive surface free from electrolyte paste.

b. Apply the electrodes firmly to the patient's skin, pressing around the entire edge of the electrode.

c. Attach snap-on or clip-on leads, assuring good contact between the electrode and the lead end. Tape the lead wire to the skin to prevent the electrode or lead from loosening.

d. Plug the patient cable connector into the ECG input connector that is in the lower front of the defibrillator, behind the carrying handle.

NOTE

Be careful to correctly align the cable plug when connecting the patient ECG leads cable to the defibrillator/monitor. Correctly orient the cable plug key with the defibrillator connector slot. If the ECG leads cable falls off or is incorrectly connected, the message LEADS OFF appears on the display.

Monitoring Electrodes

Using Electrodes

Standard multifunction defibrillator electrodes allow you to monitor through the electrodes for defibrillation and synchronized cardioversion. If you wish to use the electrodes for pacing however, you must attach separate electrodes for monitoring. To use standard electrodes, perform the following steps.

1 Attach electrodes as instructed on the electrodes package.

2 Attach the electrodes adaptor cable to the defibrillator.

3 Connect the electrodes to the electrodes adaptor cable.

4 PADS is the only selectable ECG source.

Using Paddles

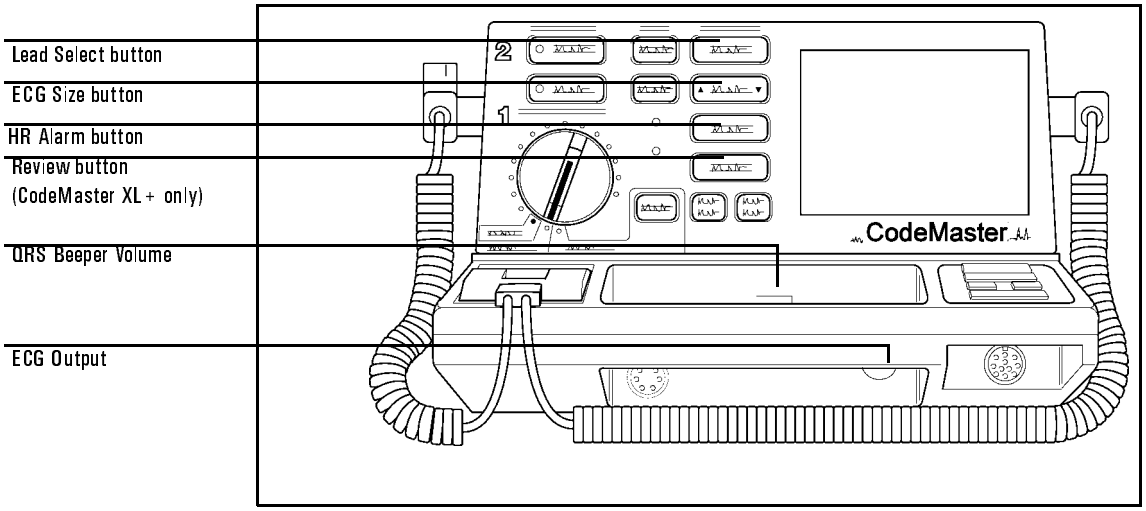
For an emergency evaluation you can monitor a patient's ECG through the paddles when leads are not attached to the patient.

WARNING

Do NOT use paddles to monitor the ECG during elective cardioversion procedures when the instrument is in synchronous (SYNC) mode. Refer to Chapter 4, "Performing Synchronized Cardioversion", for detailed information on performing elective cardioversion.

Monitoring

Figure 3-1



The Monitor Control Panel

To monitor a patient's ECG with the CodeMaster XL+, perform the following steps.

1 Prepare the patient for ECG monitoring.

2 Turn the Energy Select control to the Monitor On position.

3 Press Lead Select to select the ECG source. The selected source appears in the upper right corner of the display. For example, PADS appears on the display when it has been selected.

- If the message LEADS OFF or PADS OFF appears on the display, inspect the electrodes, patient cable, leadwires, and associated connections. If the selected ECG source is not connected, a dashed line will replace the normal ECG trace.

4 Ensure that the ECG size has been automatically adjusted for optimal size. If you wish to reduce the ECG size, press ▼ECG Size . The "gain bar" along the left side of the display represents 1 mV of signal amplitude.

NOTE

Autogain allows an initial quick setup when the instrument is turned on to automatically size the ECG based on the signal from the patient. To remove the instrument from Autogain, press ECG Size. You then must adjust the ECG size manually.

Adjust the QRS beeper volume to the desired volume.

Heart Rate Alarms

The CodeMaster XL+ provides three pairs of preset alarms. An optional feature provides three configurable pairs of upper and lower heart rate alarm limits. Each pair of heart rate alarm limits can be defined in setup menu 1 as described in Appendix A. While monitoring, you can select and enable any pair of pre-defined limits using HR Alarm.

When HR alarms are inactive, the monitor will display a bell symbol with a "\" through it: .

To select a pair of HR alarm limits, press HR Alarm until the pair of limits you wish to use are displayed. If you do not press the key again, the displayed HR alarm limits become active and the limits are replaced by the bell symbol: .

If the HR alarm limits are violated, the HR alarm limits replace the bell symbol, and the violated limit is highlighted. Pressing HR Alarm at this point will turn off the HR alarms.

If the HR Alarms are active and you wish to review the limits, press HR Alarm. The currently active pair of HR alarm limits are displayed momentarily.

If the HR alarms are active and you wish to select another pair of limits, press HR Alarm until the pair of limits you wish to use are displayed. Pressing HR Alarm repeatedly cycles through the three pairs of HR alarm limits and the HR alarms inactive choice.

NOTE

HR alarms are automatically turned off when you press [Charge].

Printing the Event Summary Record (Optional)

During defibrillator usage, the monitor stores up to 28 ECG strips of critical information called events. Events include all shocks, heart rate alarm violations, SpO_2 alarm violations and mark events. Each event record includes date of event, heart rate, ECG source, and size setting as shown in Table 3-6, “Event Summary Record Information”. The time annotated on the ECG strip is within 8 seconds of the recorded event. The message ES is printed at the top of the ECG strip when you print the Event Summary record.

Table 3-6 Event Summary Record Information

Event	Event Summary Description
Shock	Shock#, Delivered energy, peak current, and patient impedance.
Heart Rate Alarms violation	Heart Rate alarm limits.
SpO_2 Alarms violation	SpO_2 alarm limits.
[Mark] Mark	Marker symbol (▼) annotates strip at point [Mark] was pressed.

- To print the Event Summary on the recorder, press [• Review •]. The recorder must not be printing to print an Event Summary with this key. After printing an event, you must wait 10 seconds before printing another event.
- To stop printing the Event Summary, press [• Review •] or [Record].
- To review the Event Summary later, turn the unit on and press [• Review •].

NOTE

The Event Summary record is cleared each time the defibrillator is turned off, then on and a new event occurs. This allows you to turn off the defibrillator and return later to review event information such as code statistics.

Turn the defibrillator off between uses to ensure that Event Summary records are patient specific.

Recording

To print a record of the current ECG and of the monitor status, press Record .

- The upper line of the ECG strip contains a periodic report of monitor parameters (Date, Time, Heart Rate, ECG Source, ECG Size, and Recorder mode).
- The lower line of the ECG strip records asynchronous events such as Shock delivery or Heart Rate Alarm violations.
- Several graphic symbols are used to annotate events such as Shock, HR Alarms, Mark, or Sync.

A 1 mV, 200 ms calibration pulse can be printed on the ECG strip by pressing both arrows on the ▼ECG Size▲ key simultaneously.

Appendix A contains a list of configuration settings in setup menu 2 which affect recorder operation. The recorder can be configured for either monitor or diagnostic ECG bandwidth data. Delayed (6 seconds) or non-delayed operation is also configurable.

Automatic Recordings

In setup menu 2, you can enable or disable any of the following automatic recordings:

• Record on Charge

• Record on Shock

• Record on Alarms

• Record on Mark (configurable with option)

The automatic recordings for both delayed and non-delayed recorder modes of operation are defined in Table 3-7, “Automatic Recordings”.

Table 3-7 **Automatic Recordings**

Event	Delayed mode Pre-event time	Delayed mode Post-event time	Non- Delayed mode Post-event time
Mark pressed	6 seconds	3 seconds	3 seconds
Charge	6 seconds	Until Shock or Disarm event	Until Shock or Disarm event.
Shocking the patient	6 seconds	12 seconds	12 seconds
Alarms violation	6 seconds	3 seconds	6 seconds
Disarm	6 seconds	3 seconds	3 seconds
Test discharge	N/A	3 seconds	3 seconds

Post Shock Data (Optional)

As described in Appendix A, you can enable or disable the recording of post shock statistics in setup menu 2.

• If Post Shock Data is enabled, the defibrillator will record the shock delivery statistics (Actual Delivered Energy, Patient Impedance, Peak Current).

• If Post Shock Data is disabled, the defibrillator will record the energy to which it was charged as the delivered energy. For example, if the unit was charged to 200J, the delivered energy annotation on the ECG strip would be `DEL 200J`.

Recorder Errors

The message CHECK RECORDER appears if an error occurs while recording. If this message appears, check the recorder paper supply. This message may also appear if the recorder door is open.

External Monitoring

The ECG output provides an analog 1V/mV ECG signal for connection to an external monitor. Compatible external monitoring divider cables are listed in Table 3-8, “External Monitoring Cables”.

Table 3-8 External Monitoring Cables

1000:1 voltage Divider Cable Connector Type	Part No.
Six Pin	M1782A
Eight Pin	14482A/B
Twelve Pin	M1783A

NOTE

Do not use the ECG output to synchronize another defibrillator. (The ECG-In to ECG-Out delay is 35 milliseconds.)

CAUTION

The connection of external equipment may increase leakage currents. Always request that local safety personnel verify that multiple connected equipment comply with local safety standards before putting such equipment into service.

Performing Synchronized Cardioversion

This chapter contains information about performing synchronized cardioversion on a patient with the CodeMaster XL+ defibrillator/monitor.

Refer to Chapter 3, ”Monitoring” for information on patient preparation.

Performing Cardioversion

Treatment for certain arrhythmias require synchronizing a defibrillator shock with the ECG’s R-wave. It is essential that this R-wave is detected to avoid inducing ventricular fibrillation.

Monitoring During Cardioversion

Using an External Monitor

WARNING

Whenever possible, we recommend that you perform synchronized cardioversion procedures while directly monitoring the patient through the defibrillator's electrodes or leads inputs.

If you use an external monitor as the ECG source, require the biomedical technician to verify that the monitor/CodeMaster XL+ combination will deliver a synchronized shock within 60 ms of the peak of the R-wave. (See the service manual for test procedure.) Use a 1 mV QRS complex with a QRS width of 40 ms. This performance cannot be guaranteed with all commercially available monitors.

There are many ways to monitor ECG for synchronized cardioversion: use an external ECG monitor, connect ECG electrodes to the CodeMaster XL+ or use external adhesive electrodes.

External ECG monitor When the patient is already connected to bedside monitoring equipment, there is a cable which plugs into the ECG output jack of the

bedside monitor and connects to the CodeMaster XL+ for monitoring. To use an external monitor with the CodeMaster XL+, perform the following steps.

1 Select Lead I or Lead II on the CodeMaster XL+.

2 Plug the cable into the external monitor ECG Output jack and plug the input end of the cable into the ECG input plug on the CodeMaster XL+. See Table 3-8, “External Monitoring Cables” for the information on external monitoring cables.

Using ECG electrodes with the HP CodeMaster XL+ defibrillator/monitor Use a patient cable connected to the patient and select Lead I, Lead II, or Lead III, choosing the best lead that displays a large QRS complex.

Using external adhesive electrodes Use the electrodes adaptor cable (M1750A/B) and electrodes, selecting PADS as the ECG source.

Using Paddles for Performing Synchronized Cardioversion

To start cardioversion, perform the following steps.

1 Turn the Energy Select control to Monitor On.

2 Select the desired ECG lead by pressing Lead Select .

3 Press Sync once to place the HP CodeMaster XL+ defibrillator/monitor in Sync mode. The message SYNC appears on the display.

NOTE

If you select paddles as the ECG source, the message USE LEADS will appear on the display. Although the HP CodeMaster XL+ defibrillator/monitor will allow synchronized shock in paddles ECG mode, leads mode is recommended. Artifact induced by moving the paddles may resemble an R-wave and trigger defibrillator shock.

Cardioversion can be performed with the HP CodeMaster XL+ defibrillator/monitor in Autogain mode. Always inspect the displayed ECG before delivering the counter shock, and verify that an R-wave marker (indicating shock point) appears only with each R-wave. If a marker dot does not appear, or if a marker dot is viewed on the T-wave segment of the ECG, follow these instructions:

- Adjust the ECG size by pressing ▼ ECG Size▲ until the marker dot appears only with each R-wave.
- Select a different lead or apply new electrodes, if necessary, to improve ECG R-wave quality.

4 Select the desired energy level with the Energy Select control.

Applying the Paddles

1 Prepare the paddles by performing the following steps.

a. Remove paddles from their holders by grasping the handles and lifting straight up.

b. Holding both paddles in one hand, apply electrolyte paste to both paddle electrode surfaces.

WARNING

Do not allow paste to accumulate on your hands, the paddle handles, or the paddle electrodes on the patients chest to avoid the risk of electrical shock or burns.

CAUTION

Do not rub the electrode surfaces together to distribute the applied paste. Placing the electrode surfaces together increases the risk of an accidental paddle-to-paddle discharge.

2 Apply the paddles to the chest as follows.

a. Place the Sternum paddle to the right of the sternum just below the clavicle.

b. Place the Apex paddle on the chest just below and to the left of the left nipple, in the anterior-axillary line.

3 Verify again that the ECG waveform is stable, and that a marker dot appears only with each R-wave of the cardiac cycle.

4 Rub the paddles lightly against the skin to distribute the electrolyte paste and increase the contact between the patient skin and the paddles.

WARNING

Do not spread paste between the paddle electrodes on the chest. The patient can be burned if the paste forms a path between the electrodes.

5 Apply 10 to 12 kg (22 - 25 lb.) of pressure per paddle.

6 Briefly adjust paddle pressure and placement to optimize contact, as registered on the paddle contact indicator.

7 Press Charge on either the right (Apex) paddle or on the instrument front panel.

8 Wait for the Charge Done indicators.

NOTE

If you must disarm the charged defibrillator (if counter shock is not needed), turn the Energy Select control to Monitor On. Any stored energy will be discharged internally and the available energy on the display will return to 0.

NOTE

To increase or decrease the selected energy level after Charge has been pressed, move the Energy Select control to the new energy level, and wait for the Charge Done indicators.

9 Depress both Shock (⚠) buttons (one on each paddle) until shock occurs. The defibrillator will shock with the next detected R-wave.

10 If additional counter shocks are required, readjust the Energy Select control as necessary, and repeat the synchronized cardioversion procedure.

NOTE

Depending on how the unit has been configured, it will either remain in the synchronized shock mode or it will return to defibrillator mode following a synchronized shock. Refer to Table A-1 on page A-12 for instructions on configuring the defibrillator for operation after synchronized cardioversion.

If the defibrillator does not shock, refer to “If the Defibrillator does not Charge” on page 8-2.

Using External Multi-function Defib Electrodes for Performing Synchronized Cardioversion

Synchronized cardioversion can be performed with external electrodes. PADS can be selected as the ECG source for cardioversion because they are a reliable contact for monitoring. To perform synchronized cardioversion with electrodes, perform the following steps.

Applying Electrodes

1 Attach the electrodes adaptor cable (M1750A/B) to the defibrillator.

2 Attach electrodes to patient as instructed on the electrodes package.

3 Connect electrodes cable connector to the electrodes adaptor cable. The electrodes are correctly connected when the locking ring is twisted, locking the ears of the connector to the adaptor cable.

4 Turn the Energy Select control Monitor On.

If the PADS OFF monitor message is displayed, check all patient connections.

5 Select electrodes as the ECG source by pressing [Lead Select].

6 Press [Sync] once to place the CodeMaster XL+ in Sync mode. The message SYNC will appear on the display.

Cardioversion can be performed with the CodeMaster XL+ defibrillator/monitor in Autogain mode. Always inspect the displayed ECG before delivering the counter shock, and verify that an R-wave marker (indicating shock point) appears only with each R-wave. If a marker dot does not appear, or if a marker dot is viewed on the T-wave segment of the ECG, follow these instructions:

- Adjust the ECG size by pressing [▼ECG Size▲] until the marker dot appears only with each R-wave.
- Apply new adhesive electrodes to improve ECG R-wave quality.

7 Press [Charge] on the CodeMaster XL+ defibrillator/monitor front panel.

8 Wait for the Charge Done indicators.

NOTE

If you must disarm the charged defibrillator (if counter shock is not needed), turn the Energy Select control to Monitor On. Any stored energy will be discharged internally and the available energy on the display will return to 0.

NOTE

To increase or decrease the selected energy level after Charge has been pressed, move the Energy Select control to the new energy level, and wait for the Charge Done indicators.

9 Depress both Shock (⚠) buttons on the cable connector simultaneously. The defibrillator will shock with the next detected R-wave.

10 If additional counter shocks are required, readjust the Energy Select control as necessary, and repeat the synchronized cardioversion procedure.

NOTE

Depending on how the unit has been configured, it will either remain in the synchronized shock mode or it will return to defibrillator mode following a synchronized shock. Refer to Table A-1 on page A-12 for instructions on configuring the defibrillator for operation after synchronized cardioversion.

If the defibrillator does not shock, refer to “If the Defibrillator does not Deliver a Shock” on page 8-3.

After Using the Defibrillator

If you want to print an Event Summary now, press • Review •. See “Printing the Event Summary Record (Optional)” on page 3-8. After you use the defibrillator, perform the following steps to prepare the defibrillator for its next use.

1 Turn the Energy Select control to Off (Standby).

2 Return the instrument to its storage location, and plug the power cord into an AC power outlet. Verify that the BATT CHRG and AC POWER lights are on.

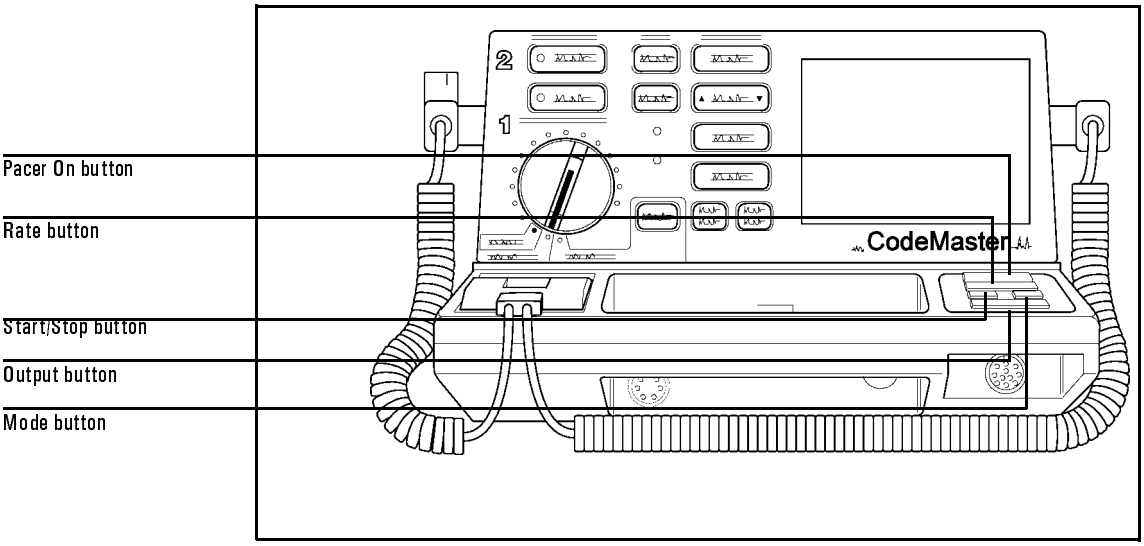
3 Clean all paddles, controls, and cables. Refer to Chapter 9, ”Maintaining the Defibrillator” for cleaning instructions.

4 Check that sufficient recorder paper and electrolyte paste or defibrillator electrodes are available for the next use of the defibrillator.

Pacing (Optional)

This chapter contains information about pacing with the CodeMaster XL+ defibrillator/monitor.

Figure 5-1



The Pacer Control Panel

The CodeMaster XL+ with the optional pacer can perform external transcutaneous pacing. The pacing option provides demand (synchronous) and fixed (asynchronous) pacing modes. The patient is connected to the pacer by external adhesive electrodes. The patient can be paced and defibrillated through the same set of electrodes.

WARNING

While pacing, avoid touching the gelled area of the pacing electrodes or the patient to prevent electrical shock.

Use only HP recommended electrodes with the external pacer option. The CodeMaster XL+ delivers pacer pulses through a low-impedance multifunction electrode. The CodeMaster XL+ does not pace effectively with high-impedance, pace-only electrodes.

Do not use electrodes for more than eight hours of continuous pacing.

The CodeMaster XL+ will pace on battery power alone. However, whenever possible, plug the CodeMaster XL+ into AC power while pacing.

Using the Pacer

To use the pacer, perform the following steps.

1 Apply the electrodes as instructed on the package.

2 Attach monitoring electrodes as instructed in “Using Leads to Monitor” on page 3-1.

3 Attach the patient cable to the CodeMaster XL+'s ECG Input connector.

NOTE

In demand mode pacing, always monitor the patient directly with the CodeMaster XL+ defibrillator. If a separate monitor is to be used, you must connect the “ECG Output” from the CodeMaster to the “ECG Input” of the monitor. This is required because the CodeMaster contains blanking circuitry that prevents its ECG from being overwhelmed by the pacemaker spikes. A monitor without this circuitry would not allow R-waves to be detected.

4 Attach the patient cable leads to the monitoring electrodes.

5 Attach the electrodes adaptor cable (M1750A) to the defibrillator output connector. Pull the latch connector toward the front of the defibrillator to lock the connector in place. See “Connecting Paddles and Patient Cables” in Appendix A for more information.

6 Attach the electrodes to the electrodes adaptor cable and turn the twist lock.

7 Turn the Energy Select control to the Monitor On position.

- If the message NO PADDLES is displayed, check that the electrodes adaptor cable connector is properly seated and latched.
- If the message PADS OFF is displayed, check the electrodes connection to the patient and to the electrodes adaptor cable.

8 Press [Pacer On] to turn the pacer on. Pacer parameters will now be displayed at the bottom of the display (PACER STOP, DEMAND MODE, 70 PPM 30 MA). The rate (ppm) and output (mA) settings for when the pacer is turned on can be selected in setup menu 1. The original rate and output settings from the factory are 70 ppm and 30 mA. The pacer is always in Demand mode when it is turned on.

NOTE

At this point, no pacer pulses are being delivered to the patient. The pacer must be started before the pacer pulses are delivered at the selected rate (ppm) and output (mA).

9 Press [Lead Select] to select the best lead for monitoring while pacing. You can only select Leads as the ECG source when the pacer is on.

- If the message LEADS OFF is displayed, check all patient cable connections.

10 Press [▼ Rate ▲] to adjust the rate. The selected rate (PPM) is displayed on the monitor.

11 Press [Mode] to select the pacing mode (Demand Mode/Fixed Mode). The selected mode is displayed on the monitor.

- When in Demand mode, the pacer will only deliver pacer pulses when the patient’s heart rate is lower than the selected pacer rate.
- When in Fixed mode, the pacer will deliver pacer pulses at the selected pacer rate.

WARNING

Use demand pacing mode whenever possible. Use fixed pacing mode (asynchronous) for cases when reliably monitoring the patient is impractical. For example, use fixed mode when there is motion artifact or other ECG noise that makes R-wave detection unreliable.

12 Press Start/Stop to start pacing. The monitor will now display the message PACING as well as the selected mode, rate and output.

The pacer will not start pacing if there is a problem with either the pacing electrode connections or the monitoring electrode connections.

If there is a problem with the pacing electrode connection, the message ATTACH PADS will be displayed briefly when you press Start/Stop .

13 Verify that the pacer pulses are well positioned in the diastole.

14 Increase output (mA) by pressing Output ▲ until the beat is captured. Selecting an alternate lead can help you to determine capture.

15 To set the lowest possible output level to capture, decrease the current by decrements of 5 mA by pressing ▼ Output .

NOTE

If the monitoring ECG lead falls off while pacing in Demand mode, the pacer will stop delivering pulses and the messages PACER STOP and LEADS OFF will appear. To resume pacing, attach a new ECG lead and press Start/Stop . Pacing in Fixed mode does not require leads to be attached for the pacer to deliver pulses.

If a pacing electrode comes off during pacing, the pacer will stop delivering pulses and the messages PACER STOP and PADS OFF will appear. To resume pacing, apply a new electrode and press Start/Stop .

WARNING

HR meters and HR alarms function during pacing, but they can be unreliable. The HR meter attempts to count QRS activity in both Demand and Fixed pacing modes. Observe the patient closely while pacing. Do not rely on HR alarms or the indicated Heart Rate as a measure of the patient's health.

Defibrillation During Pacing

If the patient must be defibrillated during pacing, perform the following steps.

1 Set the desired energy level with Energy Select control.

2 Press Charge . The defibrillator will automatically turn off the pacer and start charging. The pacer status messages will be cleared and replaced with the defibrillator Delivered Energy Display.

3 Wait for the Charge Done Indicators.

4 Call out “Clear!” to alert personnel to stand away from the patient.

5 Simultaneously press and briefly hold both Shock ( ) buttons, located on the cable connector. The shock will be delivered through the multifunction electrodes.

After the shock, the pacer remains off. Resume pacing if it is required.

SpO_2 Monitoring (Optional)

SpO_2 monitoring gives information on both cardiac and respiratory systems, and details of oxygen transportation in the body. It is widely used because it is non-invasive, continuous, easily applied and painless.

The quality of SpO_2 measurements depends on careful application of the sensor. Read the following section, “Application Notes“ (page 6-1), to understand the importance of sensor application. For more detailed information, refer to *SpO_2 Concepts* (M1722-93950).

You can use the SpO_2 monitor with sensors made by other manufacturers as well as with HP sensors. For a list of approved sensors, see the *Sensor Guide* (M1722-93970).

SaO_2 and SpO_2

Hewlett-Packard is adopting the convention of referring to the *SpO_2* parameter. Previously it was referred to as SaO_2.

SaO_2 is the term used to indicate the oxygen saturation of arterial blood.

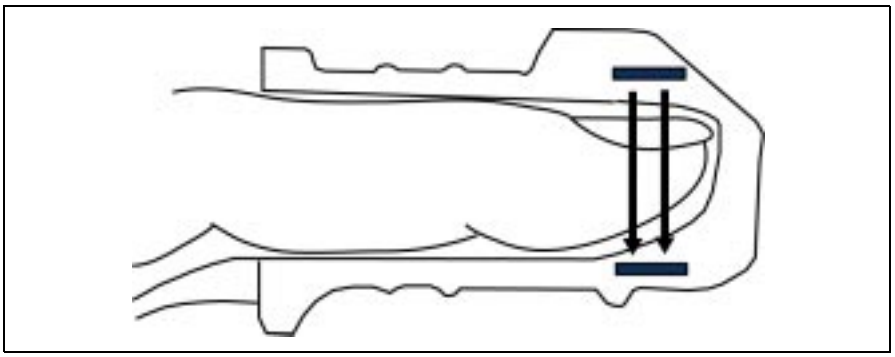
SpO_2 is the term used to indicate the oxygen saturation of arterial blood *as measured by pulse oximetry.*

Application Notes

The pulse oximetry method used for measuring SpO_2 uses LEDs (light emitting diodes) to transmit red and infrared light through suitable peripheral areas of the body, typically the foot in neonates or the finger in adults. The oxygen saturation is gauged by measuring the "redness" of the blood in the arterial pulse.

A photodetector positioned opposite the light emitter compares light absorption before and after pulsation to provide measurements that are displayed on the monitor. If there is no pulse, measurements cannot be made. See the following figure.

Figure 6-1



Positioning of the Light Emitters and Photodetector

For accurate measurements, the following conditions must apply:

• All transmitted light must pass through the extremity to the detector.

• The patient must have at least a minimum pulse.

• The light emitter and the photodetector must be opposite each other.

Using SpO_2 to Monitor a Patient

There are three types of sensors:

Disposable	Disposable sensors should be used once only and then discarded. However, they can be relocated to a different application site on the patient if the first location does not give the desired results. Disposable sensors must not be reused on different patients.
Semi-Disposable	Semi-disposable sensors can be reused, but the adhesive wrap must be discarded after each use. Semi-disposable sensors are recommended for single-patient use only.
Reusable	Reusable sensors can be reused on different patients.

Before you start SpO_2 monitoring:

1 Estimate the patient's weight, and determine the best site for the sensor.

2 Use the *Sensor Guide* to select the correct type and size of sensor for the identified location.

3 Prepare the sensor:

- Disposable: Remove protective backing.
- Semi-Disposable: Apply a new adhesive wrap to the sensor.

4 Apply the sensor to the identified location.

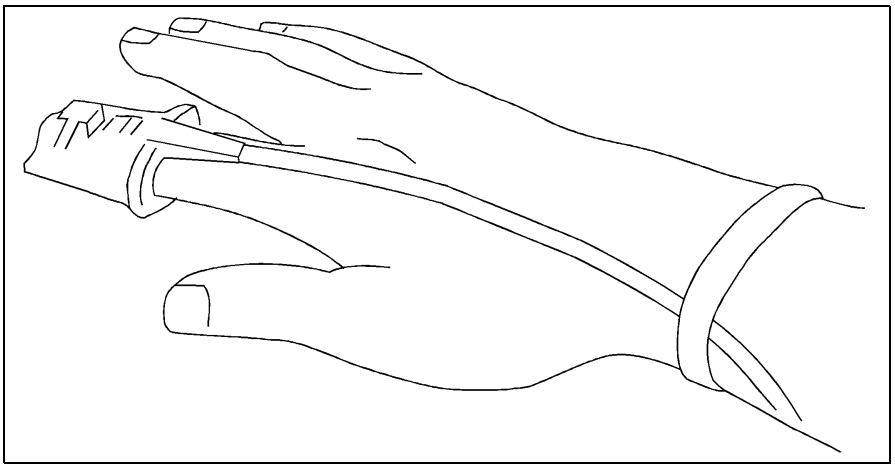
5 Connect the sensor to the monitor. To connect sensors from other manufacturers you need the HP M1900B Connector Cable.

Apply the Sensor to the Patient

The CodeMaster XL+ supports the use of many sensors. Use the *Sensor Guide* to find the sensor which is best for your case. Follow the manufacturer's guidelines for applying and using the sensor.

Application of the Reusable Sensor

Figure 6-2



Application of the M1190A Reusable Sensor

Push the sensor over the fingertip so the cable lies on the back of the hand, and secure the cable to the wrist with the wrist-strap supplied. Make sure the finger is not pinched in the end of the sensor. This ensures that the light sources in the sensor lie over the base of the fingernail, giving the best measurement results. If the sensor is not in the correct position, inaccurate readings result. In extreme cases, the instrument displays dashes instead of an SpO_2 reading. **When correctly positioned, the end of the finger just touches the end of the sensor**.

CAUTION

When non-HP SpO_2 sensors are used, application must be consistent with the manufacturer's own guidelines.

WARNING

Prolonged, continuous monitoring may increase the risk of undesirable changes in skin characteristics, such as irritation, reddening, blistering or pressure necrosis, particularly on neonates and on patients with impaired perfusion and varying or immature skin morphology. Specific attention must be given to sensor site inspection for changes in skin quality, proper optical path alignment and attachment. Check the application site at regular intervals—at least every two hours—and change the site if any compromise in skin quality should occur. More frequent checking may be required due to an individual patient's condition.

Troubleshooting Sensor Application

Failure to apply the sensor properly may cause incorrect measurement of arterial oxygen saturation.

Do not use a damaged sensor or one with exposed electrical circuits.

Patient Movement

Make sure that the application site chosen does not move excessively, which may adversely affect the performance of the sensor. You may have to replace the sensor to ensure good adhesion, or you may have to choose another application site.

Inspecting the Application Site

Inspect the SpO_2 sensor site at least once every 2 hours to ensure adhesion, skin integrity, and correct alignment of the light emitter and photodetector. Should alterations of skin integrity occur, remove the sensor and reapply at another recommended site. Avoid application of the sensor to edematous or fragile tissue. Check circulation distal to the sensor site routinely.

Circulation at Application Site

Wrapping the tape too tightly, or using supplemental tape, can cause venous pulsations that could potentially lead to inaccurate saturation measurements. Therefore, do not wrap the adhesive too tightly and do not use additional tape to

secure the sensor. High positive intrathoracic airway pressures, valsalva maneuvers, or other consequences of impaired venous return may also cause venous pulsations.

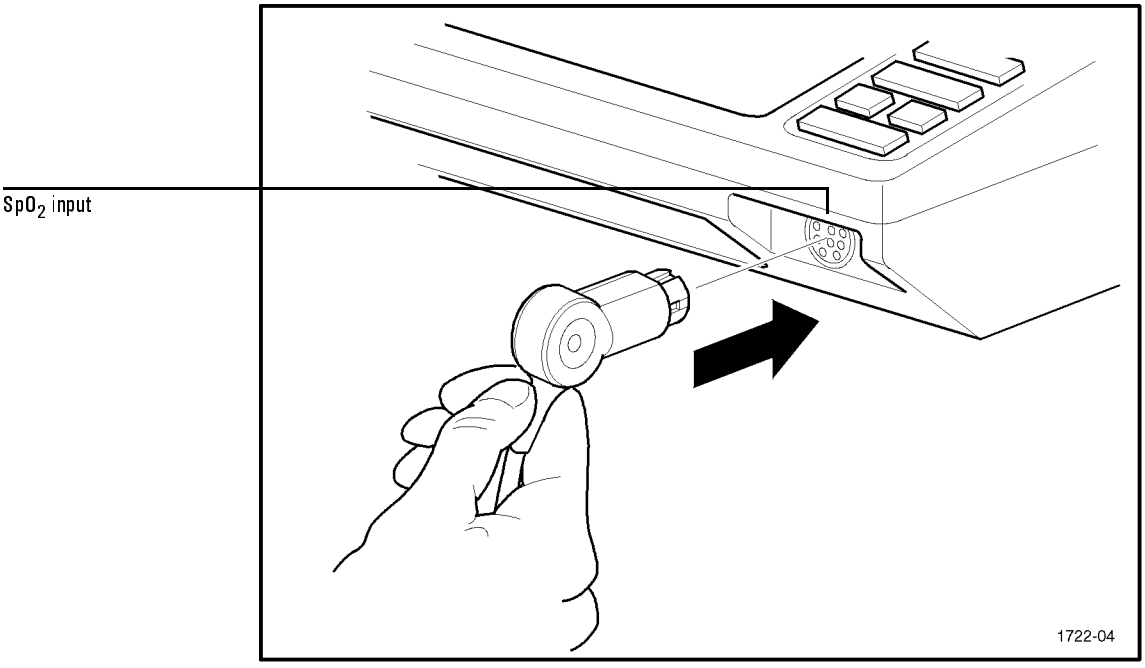
Only use adhesive wraps recommended by Hewlett-Packard.

Avoid placing the SpO_2 sensor on any extremity with an arterial catheter, blood pressure cuff, or intravascular venous infusion line.

Connect the Sensor to the CodeMaster XL+

When you have applied the sensor to the patient, plug the disposable and semi-disposable sensors into the connector cable and plug this cable into the SpO_2 socket on the lower right of the CodeMaster XL+. Plug the M1190A sensor directly into the SpO_2 socket of the CodeMaster XL+. The plug is keyed and is color-coded blue to distinguish it from the white ECG socket.

Figure 6-3



Connecting the SpO_2 Sensor to the CodeMaster XL+

CAUTION

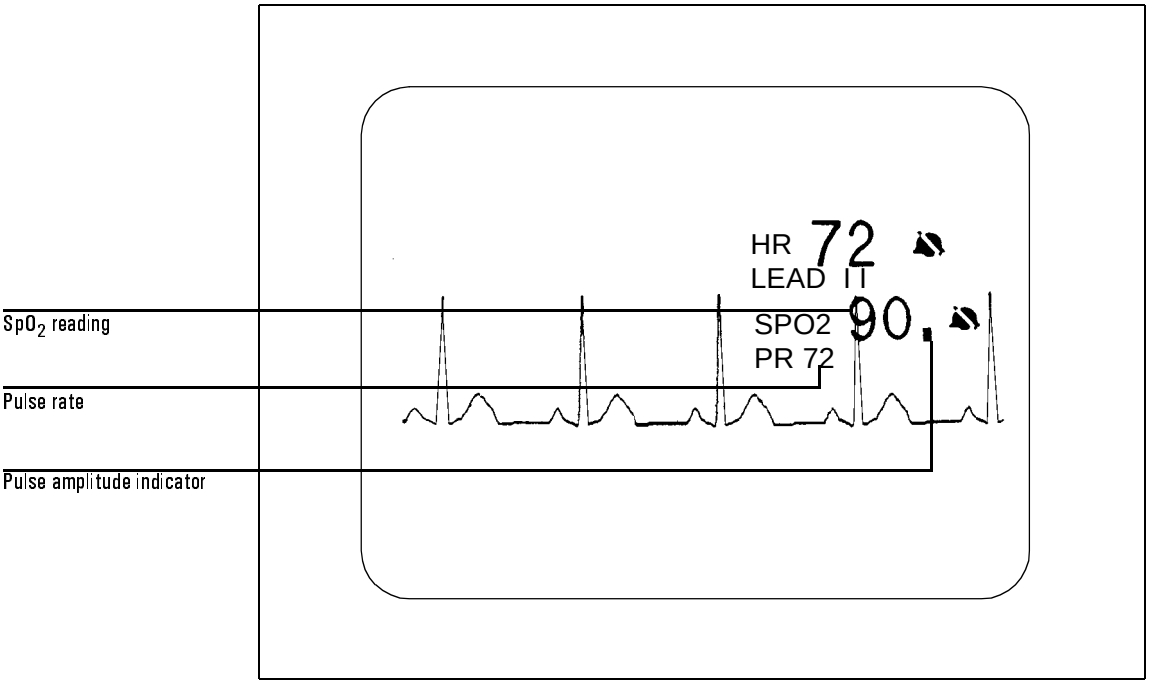
Do not force the SpO_2 connector into the ECG input socket. Doing so may damage the pins on the cable connector.

Start Monitoring

Turn the defibrillator on, if necessary, by turning the Energy Select control to Monitor On. Press the SpO2 On/Off button to display the SpO_2 reading in the upper right corner of the display.

SpO_2 Readings

Figure 6-4



CodeMaster XL+ Display with SpO_2 Reading

The **pulse amplitude indicator** shows the quality of the SpO_2 signal. Since it is derived from the patient's plethysmograph signal, it varies with the pulse of the

patient. If the patient has a very low signal the pulse amplitude indicator does not vary through its full range. If the signal is noisy, the pulse amplitude indicator does not vary rhythmically with the pulse.

The **pulse rate** is derived from the pulse oximeter. It should correlate closely with the patient's heart rate.

SpO_2 Alarms

Activating SpO_2 Alarms

There are three preset high/low SpO_2 alarm limits: 100/90, 100/85 and 100/80. Press the SpO_2 Alarm button repeatedly to cycle through the alarm options and the no-alarm option. Stop when you see the alarm you would like to choose and after three seconds that alarm will take effect. A symbol replaces the limits to show that the alarm is active. To review the limit set, press the SpO_2 Alarm button.

If the SpO_2 level falls below the low alarm limit, an alarm sounds and the violated limit is highlighted.

NOTE

SpO_2 alarms are automatically turned off when you press Charge .

Deactivating SpO_2 Alarms

Press the SpO_2 Alarm button. The symbol to the right of the SpO_2 display indicates that the alarms are off.

Recorder Output

After an alarm event, the recorder prints a strip. The bottom of the strip shows the alarm violation, and the top of the strip shows the SpO_2 reading.

With the optional Event Summary, you may print an event summary record, which contains SpO_2 information, as described in “Printing the Event Summary Record (Optional)” on page 3-8.

Using Advisory Mode (Optional)

In advisory mode, the CodeMaster XL+ acts as a semi-automatic external defibrillator.

When in advisory mode the CodeMaster XL+ can:

• analyze the patient's ECG rhythms

• advise when a shock should be administered

• automatically charge the defibrillator when shock advised

• prompt the user to deliver the shock

• provide event documentation

Using Advisory Mode

WARNING

Do not use the CodeMaster XL+ in advisory mode for:

- **children who weigh under 90 pounds**
- **patients who have an implanted pacemaker**

The advisory algorithm is not designed to detect pediatric cardiac arrhythmias or handle erratic spiking problems caused by a properly or improperly functioning pacemaker.

The advisory algorithm does not charge the defibrillator to energy levels appropriate for pediatric patients.

To use advisory mode, first verify patient condition. Then:

1 Select Advisory On.

2 Apply external adhesive electrodes.

3 Stop patient motion. Press Analyze . If `SHOCK ADVISED`, stand clear.

4 When you hear the charge done tone, press both electrodes adaptor cable Shock buttons simultaneously.

Verify Patient Condition

Confirm that the patient is in cardiac arrest:

• unresponsive

• not breathing

• no pulse

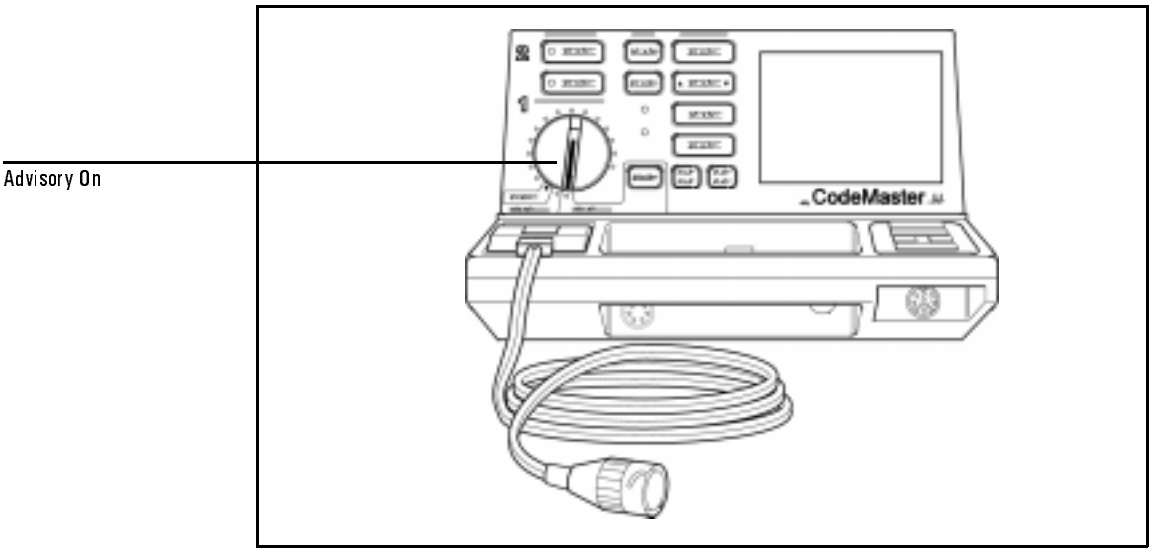
A. Select Advisory On

Turn the Energy Select/Power Control to Advisory On to turn on the defibrillator and operate it in advisory mode. The monitor displays:

```
FOR ANALYSIS,       200J
PRESS ANALYZE       SELECTED
```

where 200J is the first energy setting. You can configure the energy settings for the first, second, and third shocks by using the setup menu (refer to the Appendix, “Installation and Setup”).

Figure 7-1



Advisory On Position

NOTE

You must turn the Energy Select/Power Control to Advisory On before analyzing the ECG. Pressing Analyze has no effect unless the Energy Select/Power On control is set to Advisory On.

In advisory mode, you can use the CodeMaster XL+ to:

- analyze the patient's cardiac rhythms by pressing Analyze to determine whether a defibrillation shock is needed
- record events for the advisory mode event summary

In advisory mode, the CodeMaster XL+ emits distinct sounds as described in Table 7-1.

Table 7-1 Audible Indicators in Advisory Mode

Indicator	Description
Charge Done tone*	Continuous tone sounds when the instrument is charged and ready to deliver a shock.
Auto disarm tone	Sounds during the last ten seconds of the Charge Done tone. Beeps intermittently until disarmed.
QRS beeper	Sounds whenever an R-wave is detected. Volume controlled by front panel adjustment.
CRT/Screen alerts*	Three beeps each time a message appears on the screen and when a shockable rhythm is detected.
Shutdown warning	Alternating pitch sounds for 60 seconds when the system is about to turn off. An alert to plug the unit into AC power.

*. You cannot disable the charge done tone and CRT/screen alerts for advisory mode in setup.

When you turn the Energy Select control to Advisory On you disable other CodeMaster XL+ functions. The disabled functions include:

- charge key
- pacing
- synchronized cardioversion
- SpO_2 monitoring
- lead selection
- leads monitoring
- heart rate alarms
- automatic recordings
- standard event summary generation

• recorder delay mode

• external paddles

• internal paddles

• pediatric energy levels

Turn the Energy Select control to Monitor On or an energy setting to restore these functions.

NOTE

If you turn the Energy Select control to Monitor On or a specific energy setting, you place the CodeMaster XL+ in manual mode, and the advisory features are no longer available.

WARNING

In Advisory Mode the charge key is disabled and the defibrillator cannot be charged manually. To perform manual defibrillation, refer to Chapter 2, Defibrillation.

Do not use advisory mode for long term monitoring. Turn the defibrillator to Monitor On for long term patient monitoring.

NOTE

The Heart Rate (HR) meter is the same for manual or advisory mode when displaying or printing HR information.

The shock advisory algorithm uses a HR meter specifically developed for use by the algorithm for making shock decisions when rate information is required.

B. Apply External Adhesive Electrodes

WARNING

You must use the electrodes adaptor cable and external adhesive electrodes in the Apex-Anterior position to analyze patient cardiac rhythms when in Advisory mode.

You must use the electrodes adaptor cable and external adhesive electrodes when in advisory mode. The CodeMaster XL+ will not analyze patient cardiac rhythms through external or internal paddle sets. The message ATTACH PADS CABLE displays if the electrodes adaptor cable is not connected.

The electrodes allow accurate analysis of the cardiac rhythms and allow the defibrillator shock to be delivered. You must make sure the electrodes are correctly placed on the patient and the electrodes adaptor cable is correctly connected to the CodeMaster XL+.

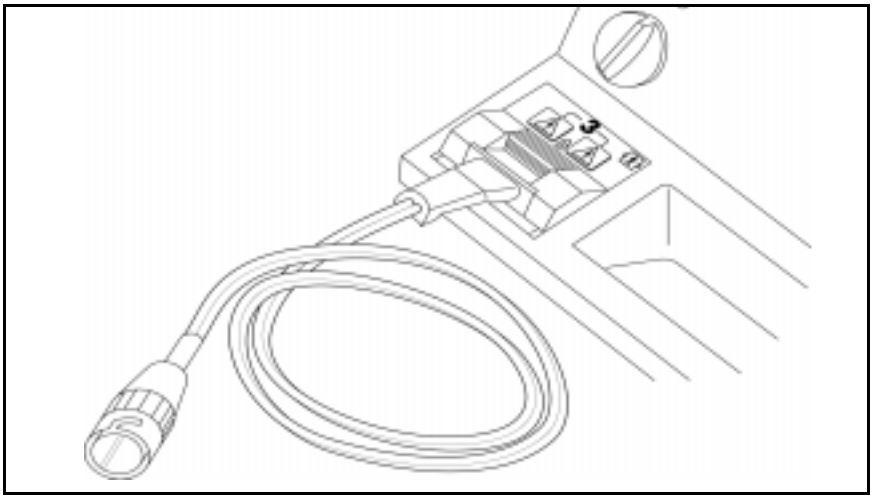
WARNING

The unit will deliver defibrillator energy levels to a set of electrodes even if they are not attached to a patient. The message PADS OFF appears when there are no electrodes or there is a poor electrodes-to-patient contact. Check all patient connections if this message appears.

1. Attach the electrodes adaptor cable (M1750A/B) to the paddle connector on the front of the defibrillator.

2. Slide the paddle connector lock towards the front of the defibrillator to secure the cable.

Figure 7-2



Connect Electrodes Adaptor Cable to the CodeMaster XL+

3 Attach the external adhesive electrodes to the patient as instructed on the package.

WARNING

Use the Apex-Anterior electrodes application shown on the package. This results in the modified Lead II configuration upon which the advisory algorithm was designed and tested.

4 Connect the electrodes to the electrodes adaptor cable. The electrodes are correctly connected when the locking ring is twisted, locking the ears of the connector to the adaptor cable.

WARNING

Be sure to correctly connect the electrodes to the electrodes adaptor cable. Incorrectly connecting the electrodes to the adaptor cable can result in a failure to deliver energy to the patient.

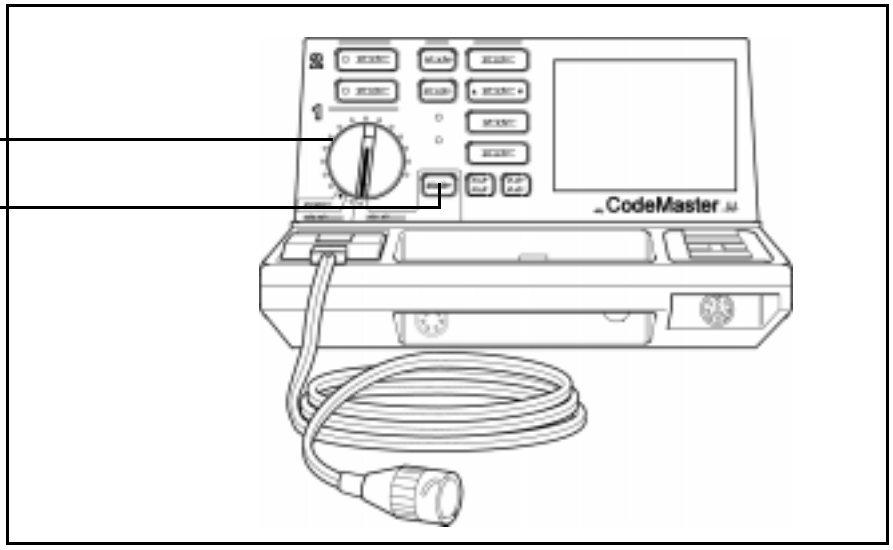
C. Press the Analyze Button

When you place the CodeMaster XL+ in Advisory mode, the monitor displays the following message:

```
FOR ANALYSIS,        200J
PRESS ANALYZE.       SELECTED
```

Begin analyzing the patient's ECG by pressing Analyze on the instrument front panel.

Figure 7-3



Analyze Button

When you press Analyze , the monitor displays:

```
ANALYZING ECG                    nnnJ
DO NOT TOUCH PATIENT             SELECTED
```

where nnn is the factory default settings for the energy sequence.

WARNING

Do not analyze the patient's cardiac rhythm in a moving vehicle or while the patient is being moved.

WARNING

To perform accurate analysis, you must not touch or move the patient during this time. Stop CPR, ventilation and transport.

The advisory algorithm needs 7 to 10 seconds of continuous, artifact free ECG data to decide whether the patient requires shock.

If excessive artifact due to CPR or patient transport is detected, the monitor displays the messages:

```
ARTIFACT DETECTED
DO NOT TOUCH PATIENT
```

If the artifact ends within 20 seconds, analysis continues. Otherwise, the messages:

```
ARTIFACT DETECTED
CANNOT ANALYZE
```

appear on the monitor, and analysis stops. You can restart analysis by pressing Analyze .

NOTE

Pressing the Analyze key during analysis will stop analysis. The message `ANALYSIS STOPPED` will be displayed momentarily, and then the message

```
FOR ANALYSIS        200J
PRESS ANALYZE       SELECTED
```

appears.

NOTE

If the external adhesive electrodes are not properly attached to the patient when you press Analyze , the message

```
FOR ANALYSIS        200J
ATTACH PADS         SELECTED
```

appears. The electrodes must be attached to the patient and the electrodes adaptor cable to start analysis.

NOTE

If the electrodes adaptor cable is not connected to the CodeMaster XL+ the message `ATTACH PADS CABLE` appears. The electrodes adaptor cable must be connected to start analysis.

D. Follow Prompts

Look frequently at the monitor and follow the displayed instructions. The monitor may display `SHOCK ADVISED` or `NO SHOCK ADVISED`.

Shock Advised

When a shockable rhythm is detected, the message `SHOCK ADVISED` displays and the defibrillator begins charging. The defibrillator charges to the pre-set energy select sequence for the first, second and third shocks. Subsequent shocks are delivered at the third shock energy level. A tone sounds to alert you that the defibrillator is charged, and the messages

```
CLEAR PATIENT!
PRESS SHOCK BUTTONS
```

display on the monitor.

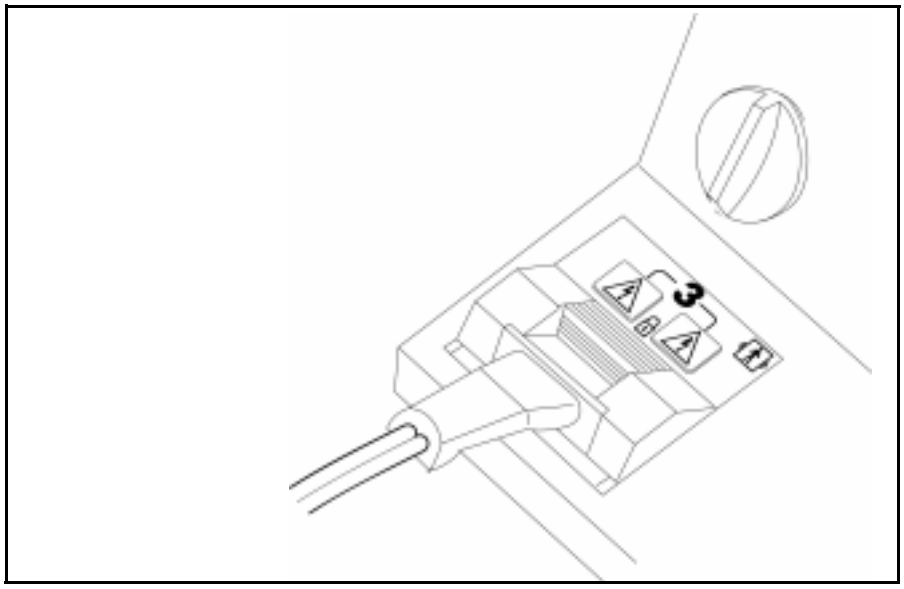
Defibrillating a Patient

1 Verify that no one is in contact with the patient, the cable or electrodes, the bed rails, or other potential current path.

2 Call out “Clear!” to alert personnel that a defibrillator shock is about to be delivered and to remain away from the patient.

3 Press both Shock buttons simultaneously to defibrillate. The Shock buttons are on the cable connector housing. If the defibrillator does not shock, refer to Chapter 8, ”Troubleshooting”.

Figure 7-4



Shock Buttons

After the defibrillator charges, press the Shock buttons promptly. If the shock is not delivered within 30 seconds, the CodeMaster XL+ disarms. If the defibrillator disarms before delivering the shock to the patient, the energy level remains the same for the next shock.

NOTE

You can disarm the defibrillator by switching the Energy Select control to the Off (Standby) or Monitor On positions. If you disarm the defibrillator by turning the Energy Select control, the energy select sequence is reset.

No Shock Advised

If non-shockable rhythm is detected, the message `NO SHOCK ADVISED` displays for about 30 seconds. Continue CPR and basic life support, as directed by your hospital's protocol. At any time, you can analyze the patients cardiac rhythm again to determine if shock is needed.

After Using the Defibrillator

If you want to print an advisory event summary now, press [• Review •]. See "Printing the Advisory Event Summary Record" on page 7-13 for more details. After you use the defibrillator, perform the following steps to prepare the defibrillator for its next use.

1 Turn the Energy Select control to Off (Standby).

2 Return the instrument to its storage location, and plug its power cord into an AC power outlet. Verify that the `BATT CHRG` and `AC POWER` lights are on.

3 Clean controls and cables. Refer to Chapter 9, "Maintaining the Defibrillator" for cleaning instructions.

4 Check that sufficient recorder paper and external adhesive electrodes are available for the next use of the defibrillator.

Printing the Advisory Event Summary Record

The advisory event summary record contains information about the resuscitation attempt while in advisory mode. When you print the summary, a header record and event summary directory print before the stored ECGs. ECGs related to events print after the directory record.

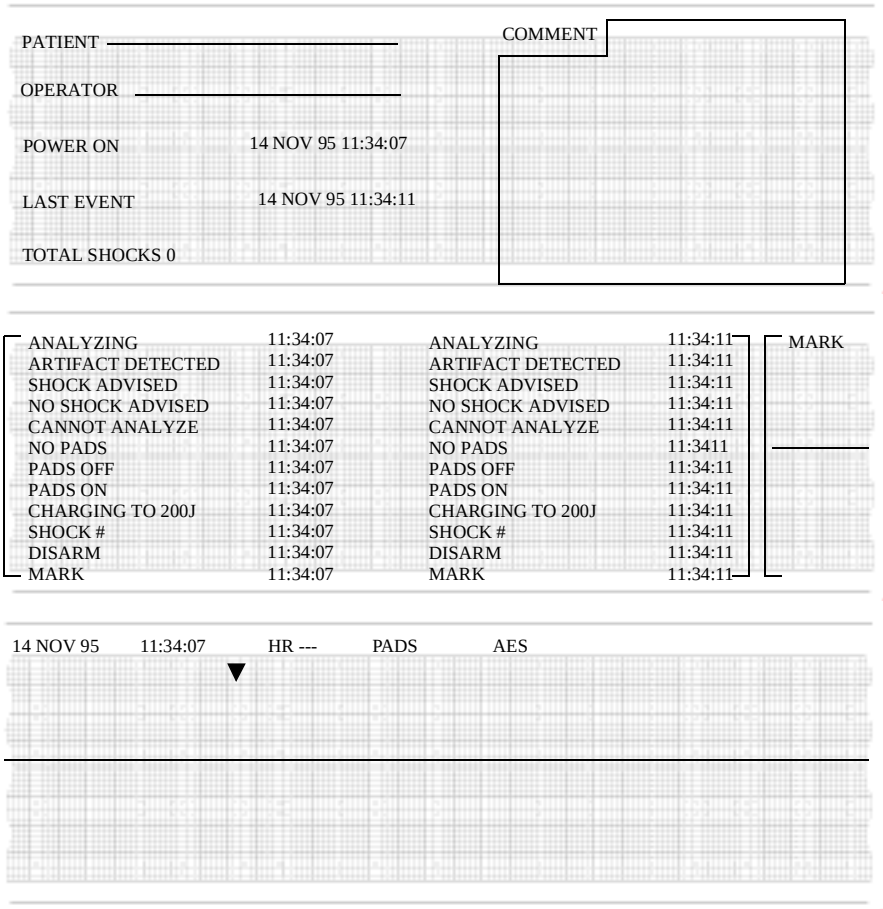
NOTE

The advisory event summary record, which is available only in advisory mode, is independent of the event summary described in “Printing the Event Summary Record (Optional)” on page 3-8, which is available only in manual mode.

WARNING

Passing through the OFF position on the Energy Select switch more than once from Advisory Mode to Manual Mode, and the initiation of an EVENT creates a NEW patient summary record which could cause the loss of data.

Figure 7-5



Advisory Event Summary Record

To print the advisory event summary record, press [• Review •].

NOTE

If the recorder is already printing other data, the • Review • command has no effect.

To stop printing the advisory event summary, press • Review • or Record .

To review the advisory event summary after the instrument has been turned off or is turned to manual mode, turn the energy select control to Advisory On and press • Review • .

The header record lists when power-on occurred, when the last event occurred, and how many shocks were delivered. The record also includes areas for you to write in the patient's name, the operator's name, and any comments about the event.

The directory lists all events that occurred during the resuscitation attempt and the time of their occurrence.

The following table lists the events the directory shows.

Table 7-2 Advisory Event Summary Record Information

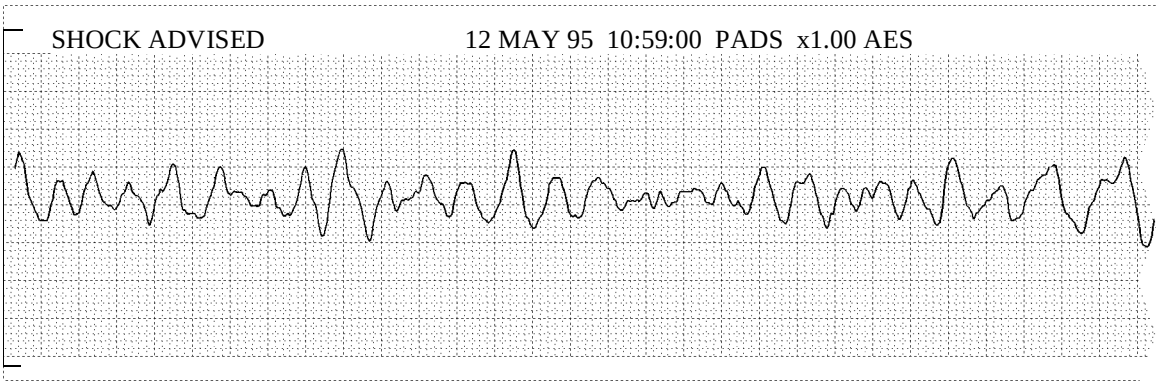
Event	Description	Notes
Analyzing	Indicates when the advisory algorithm started analysis (Analyze pressed).	
Artifact Detected	Indicates that the advisory algorithm detected excessive artifact.	
Shock Advised	Indicates when the advisory algorithm detected a shockable rhythm and advised a shock.	ECG strip recorded
No Shock Advised	Indicates that the advisory algorithm detected a non-shockable rhythm and did not advise a shock.	ECG strip recorded
Cannot Analyze	Indicates that the advisory algorithm could not analyze the cardiac rhythm.	ECG strip recorded
Analysis Stopped	Indicates that the user stopped the advisory algorithm analysis by pressing the Analyze key during analysis.	
Pads Off	Indicates that the external adhesive electrodes were removed from the patient.	
No Pads	Indicates when electrodes adaptor cable was disconnected from defibrillator.	
Pads On	Indicates when external adhesive electrodes were connected to the patient.	
Mark	Marker symbol, ▼ annotates strip when Mark was pressed.	ECG strip recorded
Charging to nnnJ	Indicates when automatic charge sequence began (after advisory algorithm advised a shock).	
Shock	Indicates when shock was delivered, delivered energy, peak current and patient impedance.	ECG strip recorded
Disarm	Indicates when the defibrillator performed an internal disarm sequence.	

The CodeMaster XL+ automatically records 11 second ECG strips for Shock Advised, No Shock Advised and Cannot Analyze events. You can record other

events by pressing Mark . For Mark events and shock events, ECGs are written from 3 seconds before the event to 8 seconds after the event is over. Approximately 200 events and 50 ECG strips can be stored.

Figure 7-6 shows a sample ECG strip.

Figure 7-6



Sample ECG Strip

Clearing Advisory Event Memory

The instrument retains event information after you turn the instrument off. Memory clears when the CodeMaster XL+ is turned on, placed in Advisory Mode, and Analyze or Mark is pressed (see Table 7-2, “Advisory Event Summary Record Information”). Memory does not clear if the CodeMaster XL+ is simply turned on, or if the instrument is used in manual mode.This allows you to turn the instrument off or enter manual mode and later return to advisory mode to print the advisory event summary record.

NOTE

Turn the defibrillator off between uses to ensure that the advisory event summary records are patient specific.

Advisory Mode Default Settings

The CodeMaster XL+ contains default settings for use in Advisory mode. Some of the settings can be altered using the Setup Menu (see “Setup” on page A-9).

The following setting can be changed:

- Default energy select sequence. You can choose to change the sequence from the factory default settings for a sequence of 200, 200, and 360 Joules, to a sequence of 200, 300, and 360 Joules. The energy level selected for the third shock is the energy level to which the defibrillator will be charged for all subsequent shocks.

- Post Shock Data: ON/OFF.

When operating in Advisory mode, the following settings cannot be changed:

- Charge done tone: always sounds.

- CRT alert tones: always sound.

- Alert tone volume: always at the maximum volume.

- Recorder delay: no delay.

- Recorder Bandwidth: always Monitor bandwidth.

- Automatic Recordings: always off.

- Power on Lead: always PADS/PADDLES.

- Notch Filter: always on.

Troubleshooting

This chapter contains information about troubleshooting and performing diagnostics on the CodeMaster XL+ defibrillator/monitor.

Troubleshooting

This section provides information about messages that appear on the display.

Table 8-1 **Failure Messages**

Message	Possible Solutions
DEFIB FAILURE	Use a back-up defibrillator and call service.
MONITOR FAILURE	Use a back-up defibrillator and call service. If there is no alternative, try to use the defibrillator without the monitor. Use Charge Done indicators to verify defibrillator functionality.
SYSTEM FAILURE	Use a back-up defibrillator and call service. If there is no alternative, try to use the defibrillator. Use Charge Done indicators to verify defibrillator functionality.

Troubleshooting the Defibrillator

Table 8-2 **Defibrillator Messages**

Message	Cause	Possible Solutions
NO PADDLES	Paddle set is not connected to the defibrillator.	Attach external paddles, internal paddles, or electrodes adaptor as required.
LEADS OFF	Leads are not securely attached to the patient or the cable is not connected to the defibrillator.	Attach lead.
USE LEADS	Paddles are connected to the defibrillator and: • Sync is pressed when PADDLES is selected.	• Press Sync to remove the defibrillator from sync mode.

Table 8-2 Defibrillator Messages

Message	Cause	Possible Solutions
	• Defibrillator is in sync mode and PADDLES is selected.	• Select PADS or LEAD I, II, or III instead of PADDLES.
	• Defibrillator is in defib mode and PADDLES is selected when leads are attached to the patient.	• Select PADS or LEAD I, II, or III instead of PADDLES.
	• Defibrillator is in defib mode, PADDLES is the ECG source when attaching leads to the patient.	• Select PADS or LEAD I, II, or III instead of PADDLES.
	• Electrodes Adaptor Cable may be defective	• Notify Service Personnel.
50J MAXIMUM	• Internal paddles are attached and the Energy Select control has been turned past 50 joules.	• CodeMaster XL+ will charge to 50 joules.
	• Electrodes Adaptor Cable may be defective	• Notify Service Personnel.
LOW BATTERY	CodeMaster XL+ is not connected to AC power and the battery voltage is below the low battery threshold.	Connect the unit to AC power.
SETUP LOST		Call for service.
DEFIB DISARMED	CodeMaster XL+ has internally discharged energy and is now disarmed.	
CHECK RECORDER	The recorder door is open. or The recorder is out of paper.	Close the recorder door, or replace the paper roll as described in "Changing the Recorder Paper" (page 9-1).

If the Defibrillator does not Charge

If the defibrillator does not charge, perform the following steps.

1 Verify the proper setting of the Energy Select control.

2 If it is correct, follow these steps.

   a. Turn the Energy Select control to Off (Standby), and then back to the desired energy setting.
   b. Press Charge again.

3 If the instrument remains unable to charge, turn the Energy Select control to Off (Standby) and use a backup defibrillator.

4 Keep any ECG strips from the defibrillator for later evaluation. If you have the optional Event Review feature, press • Review • to print an event summary.

5 Alert appropriate service personnel.

If the Defibrillator does not Deliver a Shock

If the defibrillator does not deliver a shock, perform the following steps.

1 Make sure the unit is not in synchronized shock mode. The Sync light is on when the unit is in synchronized shock mode.

2 If the unit discharges internally (that is, the energy display decrements slowly then beeps three times and displays the screen message `DEFIB DISARMED`) verify proper connections from the patient to the defibrillator. This includes connections to the electrodes/paddles adaptor cable if one is being used. Also check for worn or broken areas along the cables.

3 Press Charge again, wait for the Charge Done indicators.

4 Press the Shock buttons again.

5 If the unit remains unable to shock, turn the Energy Select control to the Monitor On or Off (Standby) position and use a back-up defibrillator.

6 If the unit is equipped with the optional Event Summary feature, press • Review • to print an event summary and keep any ECG strips from the defibrillator for later evaluation.

7 Alert appropriate service personnel as soon as possible.

Troubleshooting the Pacer

Table 8-3 **Pacer Messages**

Message	Cause	Possible Solutions
PACER FAILURE	The unit detected a delivered current error.	1 Change electrodes and make sure electrodes adaptor cable is properly connected. 2 Restart the pacer. If PACER FAILURE happens again, use a back-up pacer and call for service.
PACER OUTPUT LOW Pacer current highlighted on the display.	The pacer cannot deliver the required current.	1 Stop the pacer. 2 Change the electrodes and check the electrodes adaptor cable for proper connection. 3 Restart the pacer.
STOP PACER	An attempt was made to change pacing mode while pacing.	Stop the pacer before you change the pacing mode.
NO PADS	Pacer is on and one of the following occurs: • No electrodes adaptor attached. • Paddles attached. • Internal paddles attached.	Attach electrodes for pacing.
	• Electrodes Adaptor Cable may be defective	• Notify Service Personnel.
PADS OFF	Electrodes adaptor cable is attached and a electrode is off.	Attach electrode for pacing. If electrodes are already applied to patient, change to a new set of electrodes.
	• Electrodes Adaptor Cable may be defective	• Notify Service Personnel.

Table 8-3 Pacer Messages

Message	Cause	Possible Solutions
ATTACH PADS	Electrodes adaptor cable is attached. Charge is pressed and electrodes are not attached. Start/Stop is pressed and electrodes are not attached.	Attach the pacer electrodes.
	• Electrodes Adaptor Cable may be defective	• Notify Service Personnel.

Troubleshooting SpO_2

Table 8-4 **SpO_2 Messages**

Message	Cause	Possible Solutions
SPO2 FAILURE	The unit detected a failure in SpO_2 subsystem hardware. This failure does not affect other parts of the instrument.	Press SpO_2 On/Off twice to power cycle the SpO2 option. If the error happens again, call for service.
SPO2 SENSOR FAIL	The sensor or adaptor cable is broken.	Replace the sensor or adaptor cable.
SPO2 CABLE OFF	Sensor or cable is disconnected.	Check SpO_2 connections between CodeMaster XL+ and the sensor cable or adaptor cable.
Dashes appear on display instead of SpO_2 reading.	Can't derive measurement because: • The sensor is not on the patient. • No pulse is detected. • The sensor is incorrectly positioned. • The sensor is defective.	Check the patient for a pulse. Reapply the sensor, and make sure it is correctly positioned. If it doesn't work, replace the sensor.
SPO2 NOISY SIGNAL	Irregular pulse patterns. Patient motion.	Reapply sensor. Consider using a different sensor site.
SPO2 LIGHT INTERF	Too much interference from external light. Damage to sensor or adaptor cable.	Reapply sensor. Turn off lights in the room. If other options do not work, replace the sensor.
SPO2 LOW SIGNAL	Bad connection to patient, or patient has poor perfusion.	Check the patient for poor perfusion. Reapply disposable and semi-disposable sensors. Readjust reusable sensors. Consider using a different sensor site.

Troubleshooting the Advisory Mode

Table 8-5 **Advisory Mode Messages**

Message	Cause	Possible Solutions
ATTACH PADS CABLE	The electrodes adaptor cable is not connected to the defibrillator.	Connect the electrodes adaptor cable to the defibrillator.
FOR ANALYSIS, ATTACH PADS	Electrodes are not attached to the electrodes adaptor cable or electrodes are not attached to the patient.	Check electrodes connections.
ARTIFACT DETECTED;DO NOT TOUCH PATIENT	Excessive noise was detected by the advisory algorithm during analysis.	Do not touch, move, perform CPR, ventilate or transport the patient while the advisory algorithm is analyzing cardiac rhythms. Repeat analysis
PADS OFF	The electrodes adaptor cable is attached, but no electrodes are connected.	Attach electrodes to electrodes adaptor cable and to patient.

Performing Diagnostics

The following procedure allows complete functional inspection of the CodeMaster XL+ defibrillator/monitor.

1 Plug the power cord into an AC outlet. Verify that the BATT CHRG and AC POWER lights are on.

2 Turn the Energy Select control to the Monitor On position. The monitor trace will appear within ten seconds.

3 Press Lead Select until Lead I is displayed and verify that the message LEADS OFF appears, indicating that one or more leadwires are not connected.

4 Press Lead Select to return to the paddles ECG selection.

5 With the paper installed, press [Record] once to turn on the recorder.

a. Allow the recorder to run for approximately 20 seconds and check that Date, Time, HR (heart rate), PADDLES (ECG source), and AUTOGAIN (ECG gain mode) are noted on the ECG strip.

b. Press [Mark] and verify that the mark (t) symbol is printed. It will be delayed 6 seconds if the recorder is in the delayed mode.

c. Press [Record] to stop the recorder.

6 Press [HR Alarm]. Verify that the configured alarm limits appear briefly, then are replaced by the bell symbol in the upper right of the display. With no ECG signal, an audible alarm tone should sound within four seconds.

7 Press [HR Alarm] to turn off the alarms.

8 Verify that the adult paddle electrodes are installed.

9 Turn the Energy Select control to 100 joules.

10 Leaving the paddles in their holders, press either Charge button.

- The Charge Done indicators should occur within two seconds when operated with a fully charged battery.
- The Delivered Energy display should indicate 100 joules.

WARNING

Keep hands clear of the paddle electrode edges. Use your thumbs to depress the Shock buttons on the paddle handles.

11 Grasp the paddle handles, and without removing the paddles from their holders, press both Shock buttons simultaneously. A brief automatic recorder run prints the delivered energy test report.

12 Press [Sync] to place the instrument in Sync mode.

13 Verify that the messages SYNC and USE LEADS appear on the display.

14 Press [Lead Select] once to select Lead I, and verify that the message USE LEADS no longer appears. The message LEADS OFF should now appear, indicating that one or more leads are not connected.

15 Turn the Energy Select control to Off (Standby).

The defibrillator is ready for use if it passes the above checklist.

A more extensive test of defibrillator/monitor functionality can be performed using the diagnostic service mode described in the *M1722B CodeMaster XL+ Defibrillator/Monitor Service Manual*.

Operational Checks

These checks are intended to briefly verify the proper operation of the CodeMaster XL+ defibrillator/monitor. Regularly perform a test routine incorporating the following checks along with visual inspection of all cables, paddles, and controls.

Every Shift

Perform the following checks every shift.

- Verify that the instrument is connected to AC power, and that the `BATT CHRG` and `AC POWER` lights are on.
- Check for adequate thermal paper in the recorder.
- Check for ECG leads, electrodes, and adequate electrolyte paste or defibrillator electrodes.
- If unit is used for shock advisory, check for electrodes and electrodes adaptor cable.

Every Day

- Visually check AC power cord for wear.
- Visually check the patient cables, paddles, cables, and electrodes adaptor cables for wear, insulation nicks, and other damage.
- Ensure that the BATT CHRG and AC POWER lights are on. If the unit is plugged in and the AC POWER light is not on, the power cord may have a broken wire. If after checking the AC line the problem persists, remove the unit from service.
- Check that the BATT CHRG and AC POWER lights go off when the unit is unplugged. Re-connect the unit to AC Power.
- Perform the Delivered Energy and Shock Button Functional Test, which follows.
- If your instrument has the external pacing option, perform the Quick Pacer Functionality Test as described in “Quick Pacer Functionality Test” on page 8-13.
- If your instrument has the advisory option, turn the Energy Select control to Advisory On and check that the instrument turns on.

Delivered Energy and Shock Button Functional Test

To check the instrument with the paddles, perform the following steps.

1 Turn the Energy Select control to the 100 joules position.

2 Verify that the adult paddle electrodes are installed.

3 Push the paddles completely into their holders (Apex paddle in right pocket, Sternum in left) and press either Charge button. Wait for the Charge Done indicators.

WARNING

Keep hands clear of the paddle electrode edges. Use your thumbs to depress the Shock buttons on the paddle handles.

4 With the paddles in their holders, grasp the paddle handles and press the Apex paddle Shock button. Verify that the defibrillator does not discharge.

5 Release the Apex paddle Shock button, then press the Sternum paddle Shock button. Verify that the defibrillator does not discharge.

6 Press Sync to place the defibrillator in sync mode.

7 Press and hold both Shock buttons. Verify that the defibrillator does not discharge.

8 Press Sync again to remove the defibrillator from sync mode.

9 With the paddles in their holders, press and briefly hold both Shock buttons at once.

10 The recorder will print a test report.

To check the instrument with the electrodes adaptor cable, perform the following steps.

NOTE

Notify Service Personnel if the ECG strip does not print `TEST 100J PASSED` or if any of the shock button tests fail.

Electrodes Adaptor Cable Test

To check the electrodes adaptor cable, perform the following steps.

1 Connect the M1781A test load to the M1750A/B electrodes adaptor cable.

2 Turn Energy Select to 100 joules.

3 Press Charge . Wait for the Charge Done indicators.

4 Press the left Shock (⚡) button on the electrodes adaptor cable connector housing. Verify that the defibrillator does not discharge.

5 Release the left Shock button and press the right Shock button on the electrodes adaptor cable connector housing. Verify that the defibrillator does not discharge.

6 Press Sync to place the defibrillator in sync mode.

7 Press and hold both Shock buttons. Verify that the defibrillator does not discharge.

8 Press Sync again to remove the defibrillator from sync mode.

9 Press both Shock buttons on the electrodes adaptor cable connector. Verify defibrillator discharges.

The recorder will print a test report which will indicate the delivered energy in “Joule”, the impedance in “Ohm”, and the current in “A”.

NOTE

Notify Service Personnel if the ECG strip does not print `TEST 100J PASSED` or if any of the shock button tests fail.

CAUTION

If you see the `CHECK SETUP` message on the screen, call service to replace the backup battery.

10 Disconnect the test load (M1781A/B) from the electrodes adaptor cable (M1750A/B).

Quick Pacer Functionality Test

1 Connect the electrodes adaptor cable (M1750A/B) to the defibrillator and the test load (M1781A) to the adaptor cable. Turn the unit on by turning the Energy Select switch to Monitor On.

2 Press Pacer On (ignore the LEADS OFF message if it occurs).

3 Put the pacer into fixed mode by pressing Mode.

4 Adjust the pacer current to 30mA by pressing ▼ Output ▲. Adjust the pacer rate to 60ppm by pressing ▼ Rate ▲.

5 Start the pacer by pressing Start/Stop, and start the recorder by pressing Record.

6 Verify that the pacer pulses are shown on the recorder strip approximately every five large boxes (if the recorder is in delay mode it will take several seconds before the pacer pulses appear). Allow the pacer to run for 10-12 seconds.

7 Turn the pacer off by pressing Pacer On and stop the recorder by pressing Record. Disconnect the test load (M1781A) from the adaptor cable.

Notify service personnel if:

- PACER FAILURE is displayed on the monitor.
- NO PADS / ATTACH PADS is displayed on the monitor, yet electrodes adaptor cable is connected.
- The unit beeps three times.
- The unit displays PACER OUTPUT LOW.
- The pacer pulses are not shown on the recorder strip as described in the test.

Every Week

Perform the following checks on the internal paddle set every week.

- Check for excessive residue from sterilization on the paddle set and clean as needed. Oxidation can be an indication the paddle set is old and must be replaced.
- Check for pitting or discoloration on the electrode surfaces. Polish or replace as required.
- Ensure that the cable, connector, and electrodes have no cracks in the insulation.

Every Three Months

Have the cable set tested for electrical continuity every three months.

Every Six Months

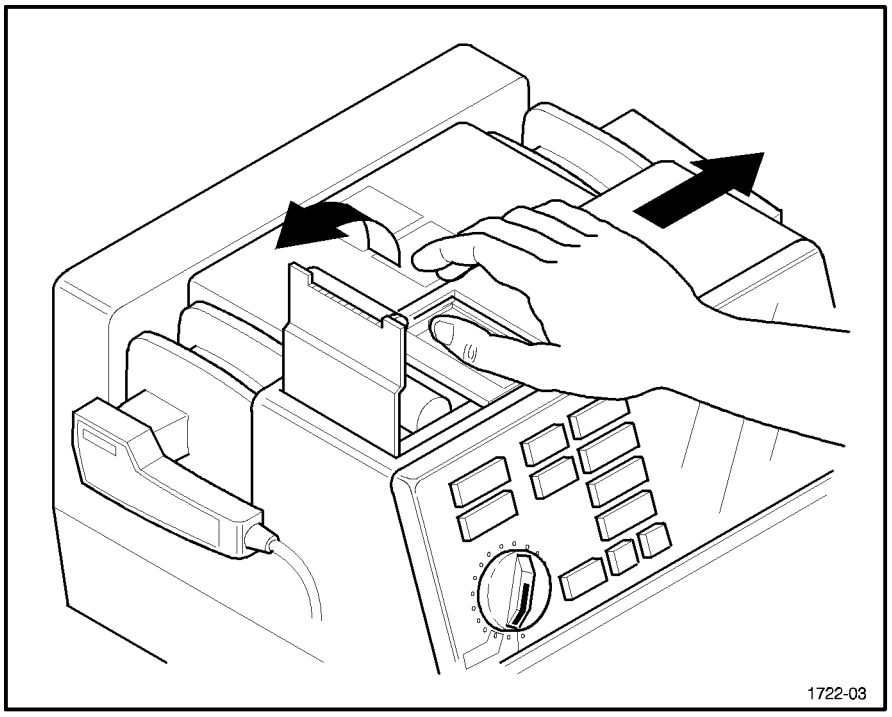
See the *M1722B CodeMaster XL+ Service Manual* for extensive electrical, operational and safety tests to be performed by a qualified Biomedical Equipment Technician (BMET) or equivalent service technician every three to six months.

Maintaining the Defibrillator

This chapter contains information about maintaining and cleaning the CodeMaster XL+ defibrillator/monitor.

Changing the Recorder Paper

Figure 9-1



Changing the Recorder Paper

To change the recorder paper, perform the following steps.

1 Slide the recorder door to the right of the defibrillator as shown in Figure 9-1. The paper platen will tilt up.

2 Pull up on the plastic removal tag to remove the empty or low paper roll.

3 Place a new roll of thermal paper (HP 40457C/D) in the recorder so that the paper unrolls from the top of the roll and the grid faces down as it comes out of the recorder.

4 Pull the end of the paper past the recorder platen.

5 While holding the recorder door open (to the right), press the platen down over the paper.

6 Allow the door to close over the platen roller.

Cleaning the Recorder Printhead

If the ECG strip has light or varying density printing, clean the printhead to remove any possible buildup of paper residue.

To clean the printhead, perform the following steps.

1 Slide the recorder door to the right of the defibrillator. The paper platen will tilt up.

2 Remove the paper roll.

3 Clean the printhead surface (above the brush) with rubbing alcohol and a cotton swab.

4 Re-install the paper roll.

5 While holding the recorder door open (to the right), press the platen down over the paper.

6 Allow the door to close over the platen roller.

Maintaining the Battery

The sealed lead-acid battery used in the CodeMaster XL+ will provide optimum life when the unit is continuously connected to AC power and fully charged after each use. To fully charge a depleted battery requires 18 hours of continuous charge time. Because it is not always possible to allow a full charge cycle between uses, the CodeMaster XL+ was designed to charge a depleted battery to 90% of its capacity in approximately two hours. However, battery capacity and battery life will be reduced if the battery is not allowed to fully charge after each use. For improved battery life, applications where the CodeMaster XL+ is used frequently between full charge cycles, consider ways to decrease the number of instrument uses between full charge cycles.

When the instrument is not plugged into AC power, some current is drawn from the battery to maintain memory and startup logic. If the battery is to be stored for extended periods (more than one month) without AC power, observe the caution in “Installing and Charging the Battery” on page A-1.

This battery was selected because it provides optimum performance and battery life over a wide range of operating conditions. The life expectancy of this battery is dependent on many variables, including temperature and usage. Periodically check the battery capacity to determine whether to replace it. The battery capacity check is described in the next section.

NOTE

When plugged into AC power the CodeMaster XL+ will function normally with no battery installed, however the time required to charge the defibrillator will increase.

WARNING

If the CodeMaster XL+ is operated without a battery installed, clearly mark that the instrument does not have a battery and requires AC power to operate. When a CodeMaster XL+ has no battery installed and is plugged into AC power, the front panel AC POWER light will be on, and the BATT CHRG light will be off.

Battery Capacity Check

Perform the battery capacity check at least once every six months. If the battery is frequently depleted without adequate time for full charge cycles, perform the check more often.

A new battery will provide a minimum of 2.5 hours of monitoring time. Hewlett-Packard recommends that you replace the battery when it fails to provide a minimum of 2.5 hours of monitoring time or 10 minutes of Low Battery warning time when starting from a fully charged battery.

To test the battery capacity, perform the following steps. This test will require up to 3.5 hours to perform (not including battery charge times). Allow 30 hours to test the battery and have it ready for use again.

1 Charge the battery by plugging the instrument into AC power for eight hours. Verify that the AC POWER and BATT CHRG lights are on.

2 Verify that there is recorder paper in the recorder.

3 Depress Sync HR Alarm while turning the Energy Select control from Off (Standby) to Monitor On. The Setup/Diagnostic Service menu will appear in a moment.

4 Press ▼ECG Size to highlight the Test Battery diagnostic test.

5 Unplug the instrument from AC power (the AC POWER and BATT CHRG lights are off).

6 Press Lead Select to start the Battery Capacity Test.

- The starting battery voltage, the current battery voltage, the Monitor elapsed time, and the Low Battery warning elapsed time will be displayed.
- When the test is finished, the recorder will print the final values of the displayed results just prior to turning off the instrument.
- Replace the battery if the recorded value for elapsed monitor time is less than 2.5 hours or the value for elapsed Low Battery warning time is less than 10 minutes.

7 Turn the Energy Select control to the Off (Standby) position.

8 Fully recharge the battery by plugging the instrument into AC power for 18 hours. Verify that the AC POWER and BATT CHRG lights are on.

9 The instrument is now ready to be returned to service.

CAUTION

The battery can be permanently damaged if left uncharged for a prolonged period.

Replacing the Battery

To install a new battery, perform the following steps:

1 Remove AC power from the instrument.

2 Place the instrument upside down on a workbench.

3 Turn the two battery compartment quarter-turn screws counter-clockwise.

4 Lift out the battery door.

5 Disconnect the battery connector and remove the battery.

6 Connect the new battery and slide it into the compartment.

7 Replace the battery door and secure it by turning the two retaining screws a quarter-turn clockwise.

8 Perform the Battery Capacity Check above before placing instrument in service.

Cleaning Exterior Surfaces

The CodeMaster XL+ and its accessories are chemically resistant to common hospital cleaning solutions and non-caustic detergents. The following list includes some approved cleaning solutions.

- 90% Isopropyl alcohol (except adaptors and patient cable)
- Soap and water
- Chlorine bleach (30 ml/l water)
- Keep the outside of the instrument clean and free of dust and dirt. Clean the paddles thoroughly to prevent build-up of dried electrolyte paste.
- Do not allow any fluids to penetrate the instrument case. Avoid pouring fluid on the unit while cleaning.
- Do not use abrasive cleaners, or strong solvents such as acetone, or acetone-based compounds.
- Clean the display screen carefully. It is especially sensitive to rough handling and subject to scratching.
- Do not steam sterilize the monitoring leads, submerge them for prolonged periods, or heat them above 50ºC. If metallic surfaces become oxidized, clean them with a very light abrasive (toothpaste). Do not use highly abrasive cleaners such as steel wool or silver polish.
- Do not steam or gas sterilize the external paddle set.

Cleaning and Sterilizing the Internal Paddles

- Clean the electrode surface and handle with common cleaning solutions such as Isopropyl alcohol, soap and water, or chlorine bleach (30 ml/water).

- Do not use acetone, enzymatic cleaners, ammonia-based cleaners or strong alkaline cleaners.

- Use a small, soft brush with cleaning solution to clean any contamination from the electrode surface and edges.

- Before sterilizing, clean any excessive residue which accumulates on the handles or electrode surfaces.

- Do no immerse the connector in cleaning solutions.

Internal paddle sets can be steam sterilized, but the severe conditions of steam sterilization will limit their useful life.

A one-year *consumables* warranty on the paddles is provided. Since the useful life of these paddles is limited, replace them when functionality or appearance is questionable. When using the sterilization procedures described in this guide, the paddles will withstand approximately 200 sterilization cycles. This will vary depending on the equipment and the process used.

Steam Sterilizing the Internal Paddles

Hewlett-Packard Company recommends the following techniques for sterilizing the internal paddles. For additional sterilization methods, see the *CodeMaster Series Defibrillator/Monitor Operating Room Paddle Guide*.

Prevacuum Sterilization

Preparation	Double wrapped in sterilization-grade wrap
Exposure Temperature	132–135ºC (270–275ºF)
Exposure Time	3 minutes

Flash Sterilization

Preparation	Unwrapped
Exposure Temperature	132–135ºC (270–275ºF)
Exposure Time	3 minutes

Gravity Sterilization

Preparation	Double wrapped in sterilization-grade wrap
Exposure Temperature	121–123ºC (250–254ºF)
Exposure Time	30 minutes

Ethylene Oxide Sterilization

Temperature	54ºC ± 1ºC (130ºF ± 2ºF)
Relative Humidity	60% ± 20%
EtO Concentration	600 mg/L ± 30 mg/L 12/88 EtO
Exposure Time	1 hour 45 minutes
Aeration Time	18 hours

Supplies

The defibrillator's warranty is only assured if you use approved accessories and replacement parts. In the United States, you can order supplies for the defibrillator by calling (toll-free) 1-800-225-0230. You can order 1290C transducers by calling (toll-free) 1-800-934-7372. You can order instrument repair parts by calling (toll-free) 1-877-447-7278.

Outside the United States, you can order supplies for the defibrillator by contacting your HP regional medical distributor.

Installation and Setup

Installation

The CodeMaster XL+ is ready for operation when the following tasks have been properly performed:

- Install battery.
- Charge battery (for 24 hours).
- Install paper.
- Make sure that the pad/paddle set connector is seated and locked.
- Select configuration settings; set date and time.

Line Voltage Settings

The defibrillator automatically adjusts to the line voltage that is supplied (from 100–230 VAC at 50/60 Hz). No manual setting or adjustment is required.

WARNING

Use only three wire power cords with three-pronged grounded plugs. Make sure that the outlet accepts the three-pronged plugs and is grounded. Never adapt a three- pronged plug to fit a two-pronged outlet.

Installing and Charging the Battery

To install the battery, refer to the battery replacement procedure in “Replacing the Battery“ (page 9-5). After installing the battery, connect the power cord to the back of the defibrillator, then plug the cord into an AC outlet. The green AC POWER and BATT CHRG indicators on the front panel should light up. (The AC POWER indicator lights when the instrument is plugged into AC power; the BATT CHRG indicator is on when the battery is installed and the instrument is plugged into AC power.)

NOTE

To ensure full battery capacity, charge the battery for 24 hours following its installation in the defibrillator.

The defibrillator operates from either battery or AC power.

Use only HP battery assembly M1758A.

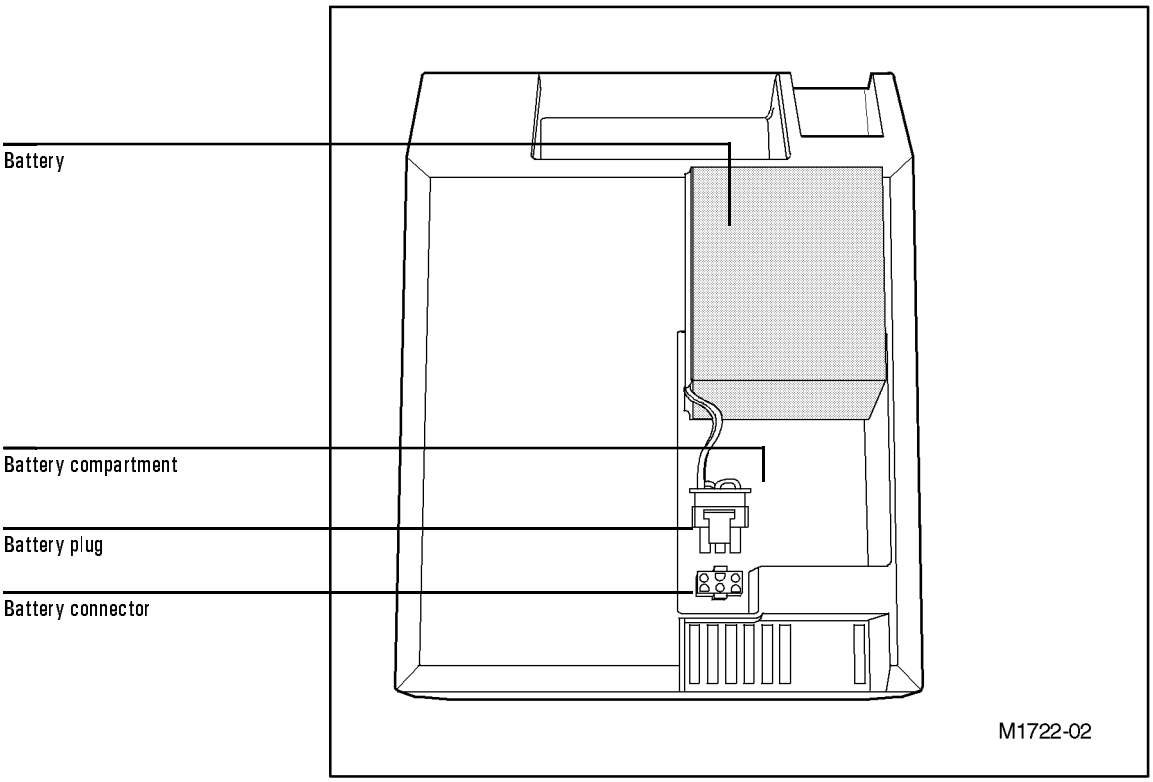
WARNING

To avoid the possibility of hazardous electrical shock, unplug the instrument from the AC power source before installing or replacing the battery.

CAUTION

If the defibrillator will be stored for longer than one month without AC power, first charge the battery for 48 hours, then remove the battery from the unit. Note on the instrument that the battery has been removed. Store the battery in a cool, dry location. Recharge a stored battery for at least 24 hours every six months. This will ensure that the battery does not completely discharge while in storage. The battery's shelf life is longer with cooler temperatures, but the battery must not be stored below freezing. After an extended storage period, the battery should be tested using the "Battery Capacity Check" (page 9-4).

Figure A-1



Installing the Battery

Loading the Recorder Paper

The defibrillator recorder uses two-inch wide, thermal paper (HP 40457C/D). To load the paper, refer to the procedure in “Changing the Recorder Paper“ (page 9-1).

Connecting Paddles and Patient Cables

The defibrillator has a paddles connector for attaching electrodes/paddles sets and an ECG Input connector for attaching leads.

Paddles Connector

The defibrillator connector accepts external paddles, external adhesive electrodes, or internal paddles.

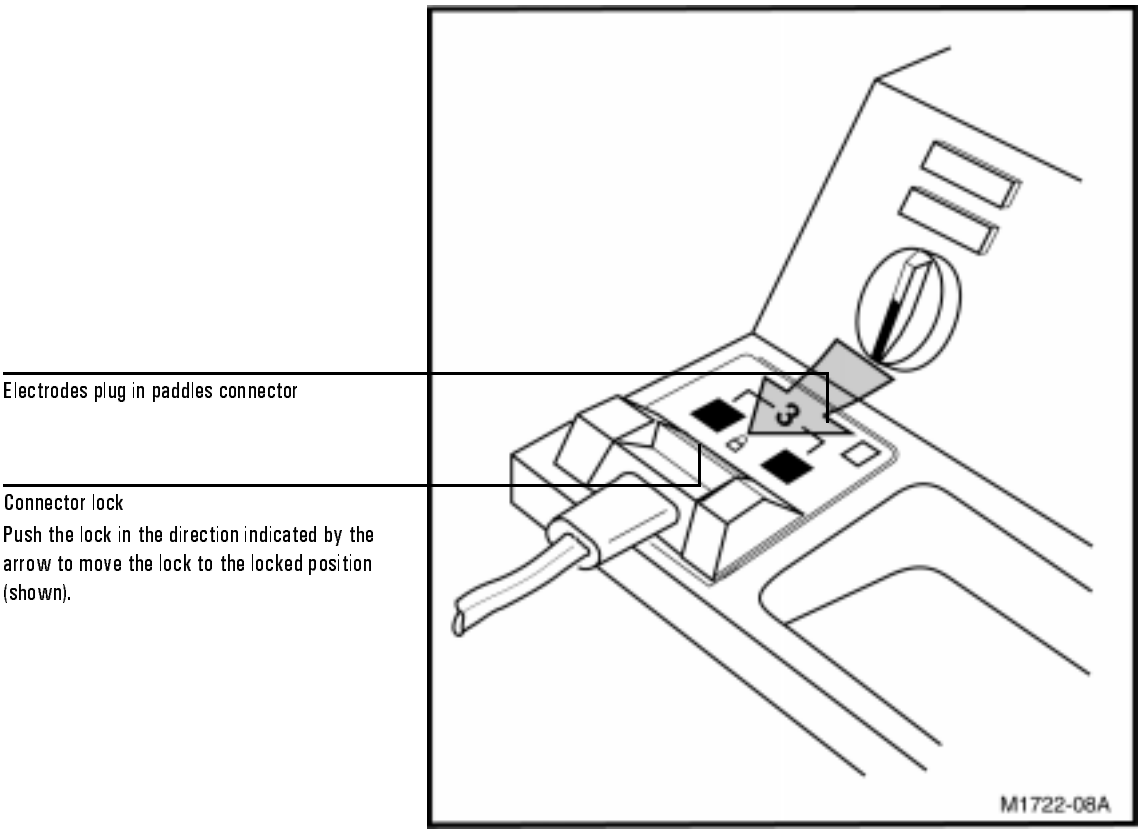
Connecting Paddles or Electrodes To connect external paddles, internal paddles, or adhesive electrodes to the defibrillator, perform the following steps:

1 Slide the paddle connector lock on the paddles plug to the **unlocked** position. To do this, push the lock toward the top of the connector.

2 Insert the paddles/electrodes adaptor cable plug into the paddles connector on the defibrillator, as shown in Figure A-2, on page A-5.

3 Slide the paddle connector lock to the **locked** position, to latch the plug in place.

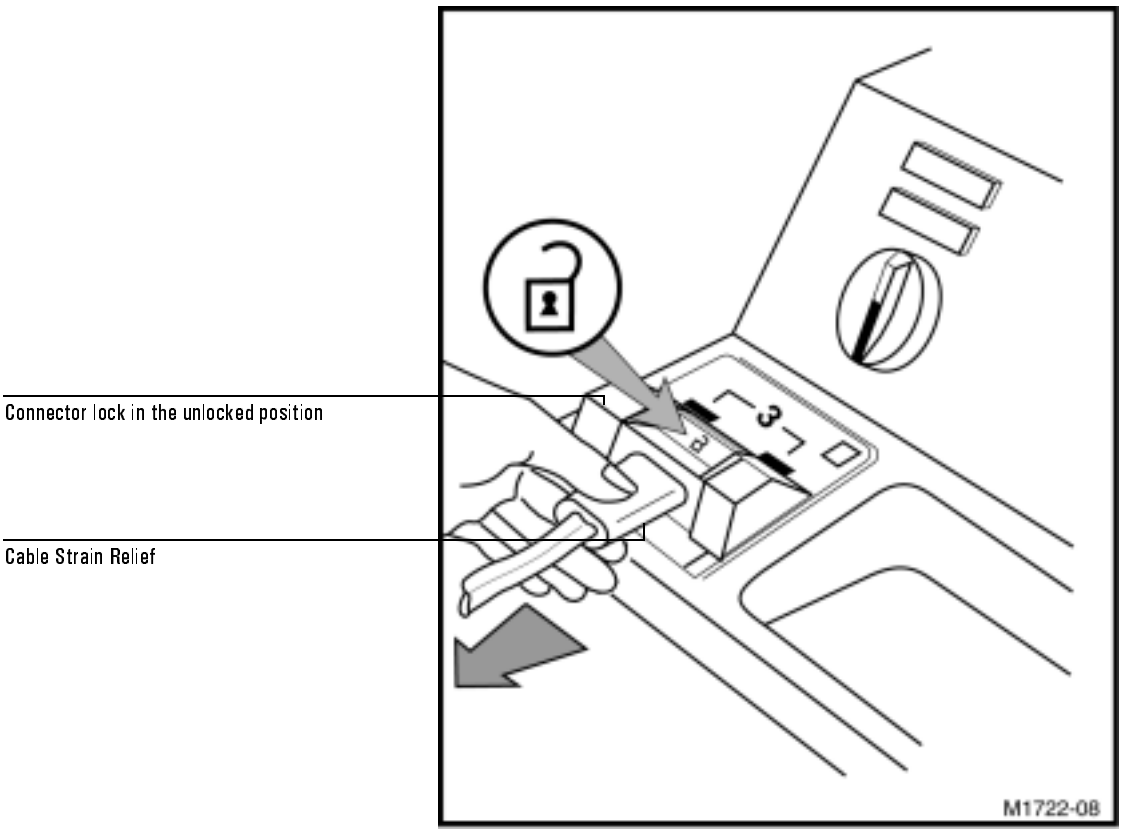
Figure A-2



Connecting External Paddles, Adhesive Electrodes, or Internal Paddles

Disconnecting Paddles or Electrodes To disconnect external paddles, internal paddles, or adhesive electrodes from the defibrillator, perform the following steps (See Figure A-3 below):

Figure A-3



Disconnecting External Paddles, Adhesive Electrodes, or Internal Paddles

1 Slide the connector lock to the unlocked position.

2 Using the strain relief, pull the connector housing up and out.

ECG Input Connector

The ECG Input connector on the defibrillator is a 6-, 8-, or 12-pin connector, depending on the option purchased with the instrument. For each connector option, several different patient cables can be used for various ECG sources and applications.

Refer to Table 3-1, “Cardiac Monitoring Configurations,” on page 3-1 for a list of available patient cables and lead sets, and their part numbers.

NOTE

3 wire = RA, LA, LL
5 wire = RA, RL, LA, LL + V (C) (optional)

Connecting a Patient Cable The 3-wire or 5-wire patient cable connects to the ECG Input connector located on the front of the defibrillator, behind the carrying handle. The patient cable plug has 6-, 8-, or 12-pins. Before installing the patient cable, make sure that the pin count of the patient cable plug matches the pin count of the ECG Input connector. To install the patient cable:

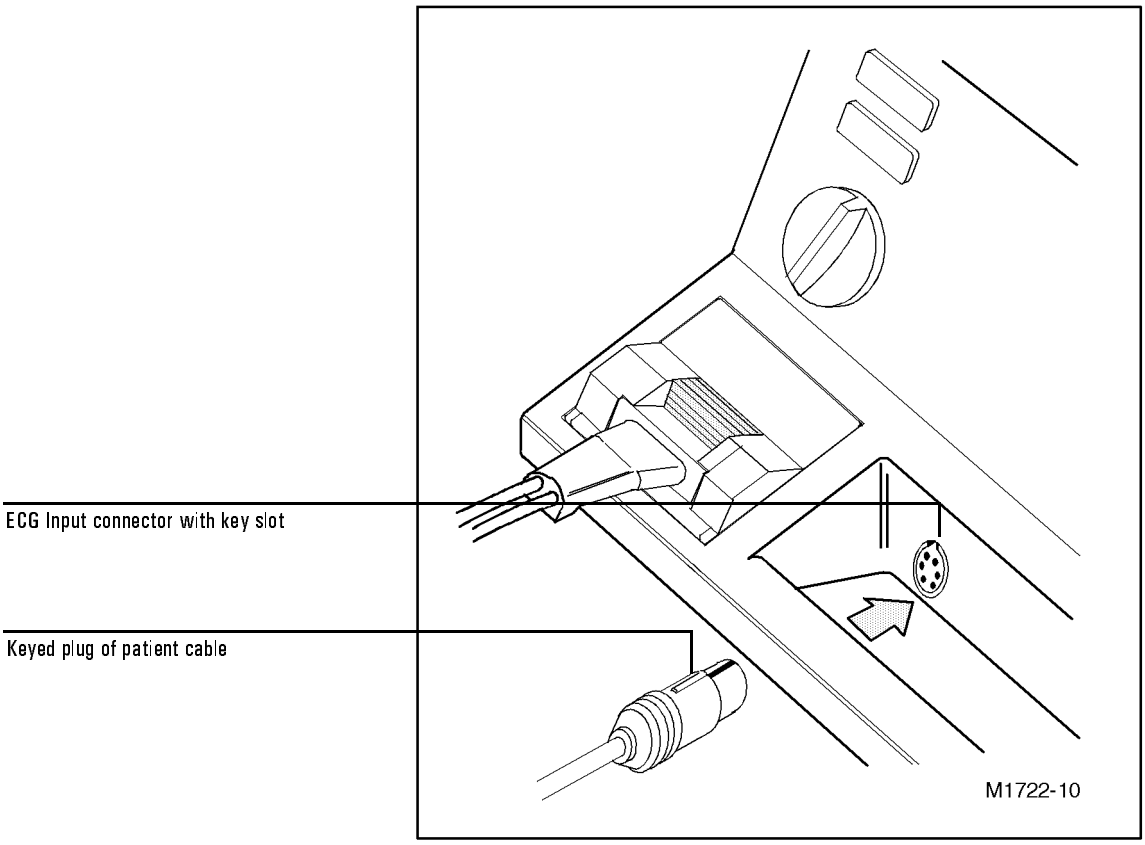
1 Align the keyed cable plug with the slot in the ECG Input connector. See Figure A-4, on page A-8.

2 Push the cable plug firmly into the ECG Input connector.

NOTE

When a lead is selected for monitoring, the message `LEADS OFF` appears on the display if the patient cable falls off or is incorrectly connected. Also, a dashed line appears on the display in place of an ECG trace.

Figure A-4



Connecting a Patient Cable

Setup

To configure the CodeMaster XL+ you must use the setup menus. The first part of this section describes how to set up CodeMaster for manual mode. The second part describes how to set up for Advisory Mode. Table A-1, “Setup Menu 1 Settings,” on page A-12 and Table A-2, “Setup Menu 2 Settings,” on page A-13 list the choices you can make on the setup menus for manual mode. Perform the following steps to configure the CodeMaster XL+.

1 Depress Sync HR Alarm while turning the Energy Select control from Off (Standby) to Monitor On. A menu will appear with the following choices.

```
CALIBRATE DEFIB
SETUP MENU 1
SETUP MENU 2
RESTORE FACTORY SETTINGS
PRINT LOG
TEST DEFIB
TEST ECG
TEST CRT
TEST RECORDER
TEST CONTROLS
TEST INDICATORS
TEST BATTERY
TEST PACER
```

2 Select SETUP MENU 1 by pressing [▼ ECG Size] until the highlight appears on `SETUP MENU 1`.

3 Press [Lead Select]. SETUP MENU 1 will appear with the current setup values displayed.

4 Press [▼ ECG Size] or [ECG Size▲] until the highlight appears on the value you wish to change.

5 Press [Lead Select].

6 Press [▼ ECG Size] or [ECG Size▲] to scroll through the available choices for this parameter.

7 When the choice you want is displayed, press [Lead Select] to set your choice.

8 Press [▼ ECG Size] or [ECG Size▲] until the highlight appears on the next value you wish to change.

9 Repeat steps 5 through 8 until you are finished configuring the settings in setup menu 1.

10 Depress both sides of the [▼ ECG Size▲] key at once to return to the setup/diagnostic menu.

NOTE

You must depress both sides of the [ECG Size] key at the same time to return to the setup/diagnostic menu.

11 To change settings in setup menu 2, select `SETUP MENU 2` from the setup/diagnostic menu and repeat the above steps.

12 Turn the Energy Select control to Off (Standby) to leave setup/diagnostic mode. You can use the factory setting for most values by selecting `RESTORE FACTORY` from the setup/diagnostic menu.

WARNING

The setting values can have critical impact on how your defibrillator operates. `RESTORE FACTORY` settings does not have a hidden menu under this heading. Selecting this line will undo user-configured parameters and restore factory defaults.
If the CodeMaster XL+ loses your configuration settings, it will display the message `SETUP LOST` on the screen and use the factory settings for all setup values. To clear the `SETUP LOST` message, go to setup menu 1 or setup menu 2. The "Setup Lost" condition will be cleared when you view the setup menus. You do not have to change the values if you want to keep the factory settings.

Table A-1, “Setup Menu 1 Settings,” on page A-12 and Table A-2, “Setup Menu 2 Settings,” on page A-13 show configurable parameters on the instrument.

Table A-1 Setup Menu 1 Settings

Setting	Choices	Description
Language	**English**, Dutch, Swedish, French, German, Italian, Spanish, Finnish, Danish, Norwegian	Printed and displayed text language.
Upper Alarm Limits (UAL)	**120**, **140**, **160**, 20 to 280 in increments of 5	Upper heart rate limits LAL to 280.
Lower Alarm Limits (LAL)	**40**, **60**, **90**, 20 to 280 in increments of 5	Lower heart rate limits 20 to UAL.
Time	HH:MM	Current time.
Date	DD MMM YY	Current date.
Armed Tone	**ON**, OFF	Beep on Charge done.
CRT Alerts	**ON**, OFF	Beep on alert message.
Alert Volume	3 to **15**	Alerts volume.
Mode after CV	**SYNC**, DEFIB	Specifies mode after cardioversion.
Pacer Rate (pacer option only)	**70** (**ppm**), 40 to 180 in increments of 10	Sets the pacer rate and the initial power-on default rate.
Pacer Output (pacer option only)	**30** (**mA**), 10 to 200 in increments of 10	Sets the pacer current and the initial power-on default pacer current.

Table A-2 Setup Menu 2 Settings

Setting	Choices	Description
Recorder Delay	**Delay 6s**, No Delay	Printout is delayed 6 seconds, or immediate.
Recorder BW	**Monitor**, Diagnostic	Bandwidth (recorder only). Monitoring bandwidth: 0.5 Hz – 40 Hz. Diagnostic bandwidth: 0.05 Hz – 150 Hz.
Advisory Energy	**200**, **200**, **360** or 200, 300, 360	Sets the desired advisory mode delivered energy sequence.
Record on Mark *	**ON**, OFF	Records during mark.
Record on Charge	**ON**, OFF	Records during charge.
Record on Shock	**ON**, OFF	Records during discharge.
Record on Alarms	**ON**, OFF	Records during alarms.
Post Shock Data	**ON**, OFF	ON prints the delivered energy statistics. OFF prints Energy Select control setting.
Power On Lead	**PADDLES**, LEAD I, LEAD II, LEAD III	Sets the ECG monitoring source that appears when you turn on the instrument.
Patient Cable	**3 WIRE**, 5 WIRE	
Notch Filter	**60 HZ**, 50 HZ, **ON**, OFF	
ECG Trace	**SWEEP**, SCROLL	ECG trace style.

*. Record on Mark and post shock data are configurable with option package only.

Specifications

Defibrillator

Waveform: Damped sinusoidal (Lown).

Output Energy (Delivered): 2, 3, 5, 7, 10, 20, 30, 50, 70, 100, 150, 200, 300, and 360 joules.

Charge Control: Push-button on apex paddle and on front panel.

Charge Time: Less than 5 seconds to 360 joules with battery present. Less than 15 seconds to 360 joules on AC only.

Armed Indicators: Charge done tone, charge done lamp on apex paddle, and available energy indicated on display.

Paddle Contact Indicator (optional): 3-color LED bar graph array on STERNUM paddle indicates quality of defibrillator paddle contact before discharge.

Paddles: Standard paddles are anterior/anterior, adult and pediatric. Adult electrodes (83 cm^2) slide off to expose pediatric electrodes (21 cm^2). Paddle cord is 10 ft (3 m). Full range of internal paddles available.

Synchronizer: SYNC message appears on monitor and is annotated periodically on recorder while in synchronous mode. An audible beep sounds with each detected R-wave, while a marker on the monitor and sync designator on the recorder strip indicate the discharge point.

Environmental Operating Conditions: 0 to 55° C, 15 to 95% relative humidity, 15,000 ft altitude.

Environmental Storage Conditions: -20 to 70° C, 90% relative humidity for 24 hours at 65° C, 15,000 ft altitude.

Monitor

Inputs: ECG may be viewed through paddles or patient cable. Lead I, II, III, or PADDLES selectable. Additional leads (aVR, aVF, aVL, V Leads) and PADS are available. Monitor and recorder indicate selected ECG source.

Lead Fault: LEADS OFF message and dashed baseline appear on monitor if a lead becomes disconnected.

Common Mode Rejection: Greater than 100 dB measured as per AAMI standards for cardiac monitors (EC13).

Display Size and Type: 5 inch (12.7 cm) diagonal CRT for 4 seconds of ECG data on screen; non-fade, fixed trace. Scrolling trace is selectable.

Sweep Speed: 25 mm/sec nominal.

Frequency Response: 0.5 to 40 Hz.

Heart Rate Display: Digital readout on monitor from 15 to 300 BPM.

Heart Rate Alarms: Three pre-set pairs of high and low heart rate alarm limits from 20 to 280 BPM. (Configurable pairs are optional.)

ECG Output: 1V/mV.

Patient Cable Length: 10 ft (3 m).

Thermal Array Recorder

Event Summary (optional): Stores and prints 3 seconds pre- and 8 seconds post-critical event data for up to 28 events. Data retained after unit is turned off.

Annotates: Time, date, HR, event marker, ECG mode, defibrillator mode, selected energy, actual delivered energy, peak current, and patient impedance.

Speed: 25 mm/sec.

Paper Size: 50 mm by 30 m (100 ft).

Recorder Mode: Automatically documents events and ECG during defibrillation episodes. The recorder can be configured to run in either real time or with a six-second delay.

Frequency Response: 0.5 to 40 Hz or 0.05 to 150 Hz selectable.

Size and Weight

Dimensions: 7.9 in H by 11.8 in W by 15.6 in L (20 cm H by 30 cm W by 39.7 cm L).

Weight: 24 lbs (10.9 kg). Includes external paddles, battery, and recorder paper.

Battery

Type: Rechargeable sealed lead-acid battery. 4 Ah, 12 V nominal.

Charge Time: 2 hours to 90% of full capacity. 18 hours to 100% capacity. Repeated charging to less than 100% will reduce useful life of battery.

Capacity: 2 1/2 hours monitoring or fifty (50) full-energy discharges or 1 hour monitoring and recording.

Battery Indicators: Illuminated LED indicates battery is charging. LOW BATTERY message appears on monitor when limited battery capacity remains.

External Pacemaker (Optional)

Current Pulse Amplitude: 10 mA to 200 mA.

Pulse Width: 20 msec.

Rate: 40 ppm to 180 ppm.

Modes: Demand or fixed rate.

Refractory Period: 40 to 80 ppm 340 msec; 90 to 180 ppm 240 msec.

SpO_2 (Optional)

Measurement Range: 0 to 100%.

Accuracy with HP M1190A sensor: 1 standard deviation, 65-80%: ±2.5%, 80-100%: ±1.5%, resolution: 1%.

Averaging: 8 beats.

SpO_2 alarm limits — range: 100/90, 100/85, 100/80.

SpO_2 alarm delay: ten seconds after value drops below the low alarm setting.

INOP alerts: Triggered by disconnected sensor, noisy signal, light interference or low signal.

Pulse rate measurement range: 30 to 300 bpm ± 1%; resolution 1 bpm.

Pulse amplitude indicator: Indicates pulsatile activity.

Advisory Mode (Optional)

Analysis time: Seven to ten seconds.

Output Energy (Delivered): factory default protocol 200J, 200J, 360J.

Analysis Control: Push-button on front panel.

Charge Time: Less than 5 seconds to 360 joules with battery present. Less than 15 seconds to 360 joules on AC only.

Armed Indicators: Charge done tone and available energy indicated on display.

Advisory Event Summary: Stores approximately 200 events and 50 ECG strips. Data retained after instrument turned off.

Waveform: Damped sinusoidal (Lown).

Calling for Service

For telephone assistance, call the Response Center nearest to you, or visit our website at: www.healthcare.agilent.com/mpgcsd/.

United States of America

Medical Response Center	Tel: (800) 548-8833

Canada

Eastern Region	**Central & Western Regions**
Tel: (800) 361-9790	Tel: (800) 268-1221

Other International Areas

Australia	**France**
Tel: 131147	Tel: 0803 35 34 33

Germany	**Italy**
Tel: 0130-4730	Tel: 0292 122999

Netherlands	**United Kingdom**
Tel: (0) 20-547-6333	Tel: 44-344-36633

Belgium	
Tel: 32 2 778 35 31	

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